

EXE

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VOL 5

ISSUE 6

The Software Developers' Magazine



Look out! It's OOP time again!

We interview Bjarne Stroustrup, inventor of C++

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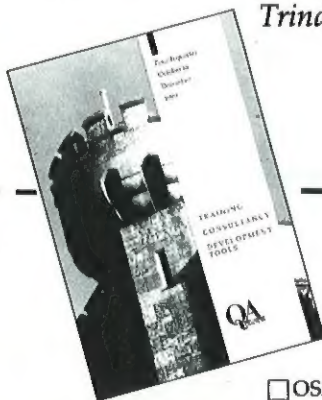
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The name of EXE Magazine is pronounced to rhyme with 'not sexy magazine'.

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Disappointment for Verity, when she meets one of her heroes. **96**

A Fair Test

According to Will Watts, the software houses and DP departments of the nation are littered with incompetent programmers. The secret is not to employ them...

There's a couple of assertions and a corollary, then we will be into the meat of the thing. Assertion 1: the ability to program a computer is more dependant on an individual's characteristic way of reasoning than on any educational process. We shall call the facility of reasoning for programming 'it'. Assertion 2: many people haven't got 'it'. Corollary: (or it may be a lemma, who cares, it's only there to annoy the anti-paradigm brigade) it is foolish to employ those who haven't got 'it' as computer programmers.

Yet, unless my time as a programme was exceptional, there are drones of people who haven't got 'it' out there. Perhaps not so much in small outfits, where such individuals are not likely to survive the three month trial (but, on the other hand, compassion may prevent prompt, direct action), but loads in larger companies, where they can often be found sitting in small, dark offices, reading newspapers.

I'll tell you how to detect the man that hasn't got enough of 'it'. He's the chap that comes up to your desk, smiles sweetly, and asks how to use a library routine that you wrote a couple of months back. So you scribble on the whiteboard, and show him examples, and write down the particular form of call that he needs on his pad; all he needs to do now is go back and type it in. All the time you are doing this, he is nodding and smiling and making little grunts of affirmation. As he turns to go, however, he will betray himself with some completely inane remark: 'Just one thing, though. What is the difference between the first parameter and the first argument'.

Recently, I set out to find a new Staff Writer for this magazine. I decided that as well as being literate and knowledgeable about the computer industry, I needed somebody who was a competent programmer, who could see issues from a programmer's point of view. Somebody, in short, who had 'it'. How to detect 'it'?

I considered the usual methods (as applied to me) of assessing candidates. First there is the CV. Qualifications are near useless. I've known plenty of non-programmers with Computer Science or Mathematics degrees or A-levels. Ability in maths, incidentally, says nearly nothing about ability to program. My maths master, who could integrate any function you care to name all over the complex plane, thought my BASIC 'Bomber' program was magical. Employment history is also potentially misleading - it could just be a list of other dupes, written out in reverse chronological order.

You can't decide whether a candidate has 'it' from an interview. All you can do is decide if he is good at being interviewed. The stereotype says that all programmers are hopeless introverts, so I suppose, if you are prepared to back the stereotype down the line, you could accept the most hopeless, embarrassed interviewee. I don't back the stereotype; besides, I was trying to fill a journalist's post - the ability to communicate easily was moderately desirable.

The other, not-that-useful thing that you can find out from an interview is whether the victim knows all the switches on the Microsoft C compiler, and whether he can remember if the Motorola 6809 supports an instruction for shift left logically register1 by register2, and what the mnemonic is. To judge from recruitment adverts ('...candidate will have real time experience using Pascal on a VAX 11-780, connected via a VT220 terminal, with the left hand LED keyboard design'), most employers appear to think that in-depth knowledge of their particular programming setup is the most valuable thing a candidate can offer. I disagree. The good programmer can adjust to an

environment very quickly; but you will never get any useful work out of the man who hasn't got 'it'. People without 'it' have a lot of spare time on their hands while they are not writing any programs; some of them use it to memorise system commands and to learn new programming languages. Knowledge is no substitute for skill.

OK, clever guts, so what did you do? Thought you'd never ask. I made my candidates write (and debug) a short program called REVERSE. It accepted a number of command line arguments, then printed them out, in reverse order, in caps. REVERSE Hell to go printed GO TO HELL. Experiments on colleagues suggested that a competent programmer, working in his own machine and compiler, with no other pressures, can do this in about five minutes. (Try it yourself. On your marks, set, go!). The average candidate, sweating away in his suit, took rather longer.

The best attempt that I recorded was by one Mr Dan O'Brien. A warm, congratulatory round of applause for him, please. Although this was by no means the sole determining factor, a glance at this month's mast-head shows that I practise as I preach. So does my system deliver? You decide.



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Sycero for Turbo C++

Fans of Sycero C, the dBASE-like C program generator, will be pleased to know that the package is now compatible with Turbo C++. The package now makes full use of Borland's VROOM memory manager. No sign of any clever object-oriented code generation, though. The new Sycero C retails at £595+VAT; upgrades are £30. System C, the maker, is on 0622 691616.

I can wait all day, you know...

Xtree has offered an amnesty to bootleggers of their popular (evidently too popular) file management program. Again. This new amnesty extends from October 1st to December 31st and is especially for UK users; unauthorised users need only send a screen dump of their Xtree screen plus £30 to: Xtree Amnesty Programme, EPI (forwarders) Ltd, Unit 6, Saxon Way Trading Estate, Harmondsworth, West Drayton, Middlesex UB7 0LW. Penitents receive the latest version of XtreePro and a 120-page user's manual.

C Portability Verifier

The C Portability Verifier is a software package from Marosi Ltd and Mindcraft Inc that checks C programs for portability to ANSI, POSIX and X/Open standards. The program can be adapted to check for user-defined profiles of standards and options. It's available for Apple, DEC, HP, IBM and SUN UNIX systems, and for all systems running SCO or Interactive Systems UNIX. Prices start at £495. Marosi is on 0344 873155.

Educational C++ price cut

One for our academic readers here: Borland has released an Academic Edition of Turbo C++ for £39.95. This is a 'streamlined' (ie cut-down) version of the standard package, containing the User's Guide and Getting Started manuals, and a small model C++ compiler. The small model allows you 64 KB of data and 64 KB of code. The complete Turbo C++ package is available to students via the Scholar programme for £69.95. Borland's product line is 0628 771070.

They would, wouldn't they?

A study, commissioned by Microsoft, has been made in the US comparing the effects on 'worker productivity' of GUIs and ordinary character-based software (now rechristened CUIs - Character User Interfaces). The study predictably found that GUI users worked faster and more accurately, required less training, were better able to self-teach, were less frustrated etc.

First ANSI C Compilers

Three British companies are celebrating the announcement this month of the world's first official ANSI X3.159-189 (C) compilers. They are: TopSpeed C for MS-DOS and OS/2 (Jensen and Partners), Inmos's MS-DOS and Sun hosted transputer cross compilers, and Knowledge Software's MS-DOS and Sun to C Standard Abstract Machine.

JPI (071 253 4333) will be particularly pleased, because this makes TopSpeed C the only MS-DOS ANSI C compiler on the market. TopSpeed C is a full editor/compiler/debugger package with a built-in MS-DOS multi-tasker and an environment that is better than most at providing multiple language development. Despite being an entirely professional product, TopSpeed C has not yet been accepted into the first

division of MS-DOS C Compilers. The BSI's announcement should give JPI a welcome boost.

Inmos is another surprise name. In the past, Inmos has played down the use of C cross-compilers for the transputer, preferring to push occam as the language of choice for parallel applications. The BSI announcement suggests that Inmos is becoming more sympathetic to the perceived difficulties of porting software to the transputer. Full ANSI compliance will be a handy lure for new customers.

Even the BSI has done well. In announcing now, it has beaten the Americans to a full validation suite by at least three months. The US standards body, NIST, is still preparing the final drafts of its validation service, and will not be ready to issue certificates until next year.

Windows Graphics

Brighton-based Bits Per Second is best-known for dGE - a library of graphics functions that works with most of the dBASE dialects. Its new product, Graphics Server, provides business graphics (bar charts, 2D and 3D pie charts, scatter graphs and so on) for the Windows 3 programmer.

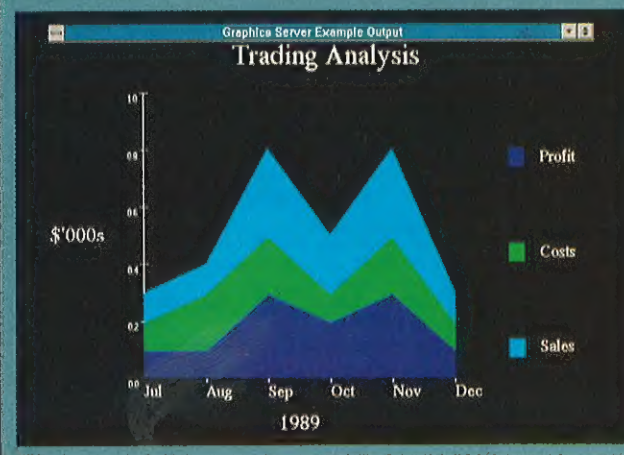
BPS is pushing the high-level API as the package's selling point. Our picture was generated from the following fragment of code:

```
// Assume data set up:
// NUMMONTHS = 6, NUMVALUES = 3
// fValues contains
//      6 x 3 data values
// szLabels contains
//      6 month name strings
// szLegends contains
//      3 data legend strings

AGOpen();
AGamp( NUMMONTHS, NUMVALUES,
      &fValues[0][0]);
AGLabels( NUMMONTHS, szLabels);
AGLegend( NUMVALUES, szLegends);
AGTitleG( "Trading Analysis" );
AGTitleX( "1989" );
AGTitleY( "$'000s" );
AGShow( AGAREA, AGAREAABS, 0);
AGClose();
```

As you can see, all the wearisome business of scaling and positioning is handled automatically - it's a bit like the procedure to generate a graph from within a spreadsheet like Lotus 1-2-3. For those who wish to retain control, and are prepared to do the extra work, a lower-level interface, made up of over 100 function calls, is also available.

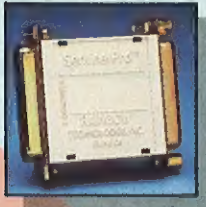
The implementation of Graphics Server is interesting. The Server itself runs as an independent application. You link your program to a supplied DLL, which then sends command messages to the server. Graphics Server also offers DDE, and can provide a front-end to Excel, Word for Windows etc as well as application development tools such as C, SQLWindows and Superbase 4. One copy of the run-time program can service several applications simultaneously.



Graphics Server costs £350 for the full development kit, with extra run-time copies (boo! hiss!) priced from £15 to £35 each, depending on the quantity ordered. BPS is also offering Chartbuilder (£145) which uses the same technology to provide easy-to-use graphics for Superbase 4 users. BPS is on 0273 727119.

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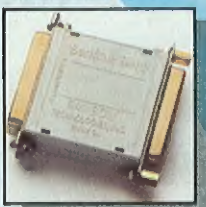
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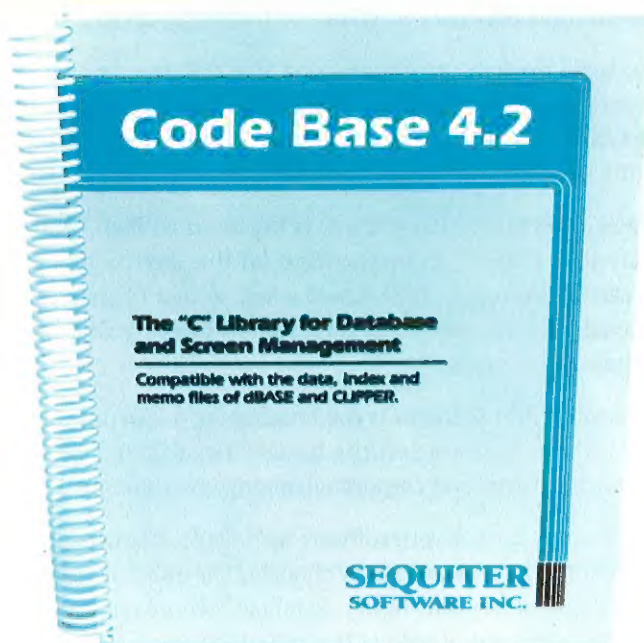
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LAN Manager V2.0 out

Microsoft has announced the new version of LAN Manager, its networking software package. The principal new features are improved security, uninterruptable power support and integration with Windows 3. The pricing scheme is new, too: rather than have different units for differing network sizes, LAN Manager supports 10 users per package. If you have more users, you simply buy more packages. Each 10 user pack costs £795. An infinite user package costs £4,375.

One of the other promised improvements with V2.0 is 'easy menu-driven installation'. Not quite what users with OS/2 V1.2 Extended Edition have been saying: apparently, the early documentation covers Standard Edition only, and the installation program just packs up when faced with V1.2 Extended. Microsoft say it's working on it, but I'd ask first. They're on 0734 391123.

PROLOG-2 for Windows-3

It's good to see that a few companies are taking advantage of 386 features, without feeling that they need to use kludgy DOS extenders. Expert Systems Ltd has released the first Windows 3 PROLOG. PROLOG-2 for Windows-3 is a full 32-bit application, running in enhanced mode only. That means that the full memory of the 386 plus all Windows' virtual memory are available, giving PROLOG a 64 MB address space. ESL used Windows' 32-bit dynamic linked library feature to provide a system call handler and has thus managed to dispense with the DOS extender used on earlier PROLOG-2 versions.

DLLs also mean that PROLOG can call C routines, and vice versa; it's even possible to invoke PROLOG-2 as an 'embedded system' in the middle of a C application. ESL have also thrown in SAA compliance, and a 500 KB Windows help file. No run-time licences are needed; another advantage, ESL say, of avoiding DOS extenders. PROLOG-2 for Windows-

3 needs at least 4 MB of memory, and an 80386 or 486 PC running Windows, natch. Tel: 0865 794474.

NAG Maths Library for C

NAG is a non-profit organisation which produce high-quality maths libraries for academic and business interests. The company compiles its libraries from the advice of over 200 world experts, and NAG has been refining them since 1970.

Unfortunately, the NAG libraries were until recently only available in FORTRAN, Pascal and Ada. Now the company has launched its C Library, Mark 1. This first collection includes Fast Fourier transforms, cubic spline interpolation, eigenvalue calculations, sorting and trigonometrical functions. More exotic functions should be available later in the year, and will be sent automatically to those subscribing to the service. The NAG C library is available, priced £600 for MS-DOS systems. Phone 0865 511245 for details.

New Port of Calls for Lattice Users

Lattice C for MS-DOS and OS/2 machines is no longer being supported by Lattice's parent company, the SAS Institute. Dispossessed users will be pleased to hear that some of Lattice's old 80x86 team have formed a new Chicago-based company, called Crystal Software. Crystal has just released two C library suites, designed for users of Lattice C who now need to move to other MS-DOS compilers.

LC-PORT is a collection of libraries containing the code of the Lattice C V6.0 runtime library, rewritten and relinked for the Microsoft, Borland, Watcom and Zortech compilers. The package also includes Lattice-compatible header files and full documentation. AP-PORT is the same trick worked upon the additional application libraries bundled with Lattice C.

LC-PORT and AP-PORT cost £85 each, and are available from Roundhill Computer Systems, Tel: 0672 84 535.

Norton Utilities on UNIX

Amarante is now distributing Norton Utilities for 80386/486 UNIX System V users. The package includes the UnErase utility, and costs from £250. For those interested, the contact number is 0707 275621.

ARAGO dBase news

ARAGO dBase, the new release of the Windows-compatible, dBASE IV almost-compatible database should be available this month from WordTech, priced at \$695. A code profiler and source debugger will be included in the package. WordTech is on 0101 415 254 0900.

More juice for the 387

Intel has announced that its fast 387 maths co-processor is now available at 16, 20 and 25 MHz. The new chip runs up to 20% faster than the corresponding old versions. Until now, only faster 33 MHz chips has been available. Intel can be contacted on 0793 69600.

Remember Tiny BASIC?

The latest BSI programming standard has just been announced. It's BSI 7149: 1990-The Specification for Minimal BASIC. Copies of the standard are available priced £47 from BSI Sales, Linford Wood, Milton Keynes, MK14 6LE.

SDK for Open Access III

Open Access III, SPI's integrated business package now has a software developers kit. The Open Access III Open Architecture Development System with Language Call Libraries (catchy name) costs £495, works with Microsoft C, and is available from SPI on 0734 844081.

Microrim Promotion

In order to promote the comparatively obscure R:BASE PC database system, Microrim (0344 869123) is offering V3.1 of the package at £125 to anybody trading in dBase 'or any other commercial PC database product'. dBase III/III+ users are especially targeted, as R:BASE can manipulate their data directly. R:BASE usually retails at £595.

X/Open News

X/Open (AT&T, HP, DEC, IBM etc) has launched six volumes containing the advance specifications of various proposed standards. The topics covered are: PC interworking, enhanced SQL, ISAM, distributed transaction processing, file transfer, and a comparison of OSI profiles. Each one costs \$40. Copies and a complete list of X/Open publications are available from X/Open on 0734 508311.

Lotus shows off Object-Oriented Spreadsheet

Business Computing '90, the Dr Jekyll side of the now bifurcated PCW Show, was not exactly Innovationsville for developers. Those nice Lotus people, though, were showing a beta version of a rather interesting new spreadsheet system on the Next stall. Lotus Improv caught .EXE's eye because its major innovation is to incorporate object-oriented design into spreadsheet use. Regions are treated as objects, and the software is intelligent enough to recognise that a value is a member of, say, 'Ford', 'Estate Car' and 'Price' objects, and that it should inherit some of those regions' characteristics. Confused? Well, Lotus are rather proud of how intuitive Improv is, and it certainly seems smart - although I'm blown if I know how it works. They also claim that it would have been impossible to write without object-oriented languages and an object-oriented OS. Which is why they're doing it on the Next.



Memory Blues

PS/2 owners can now join in the game of fiddling with your memory map in order to get a quart of a pint-sized 640 KB. BlueMAX, from the same people that produce the similar non-PS/2 386MAX, lets you move TSRs into high memory, compress the space occupied by the BIOS and generally monkey around in the search for a few extra KB. BlueMAX costs £99, from IDS (071 631 0548).

Easier Paradox access from C

PARAGen is a C code generator that allows writers of applications using Borland's Paradox engine to ignore individual field structures. Concept Dynamics, an Illinois company, developed it initially to handle problems they had when dealing with a large number of Paradox files with varying field characteristics. The system provides C programmers with a set of generic functions for opening, creating, searching, sorting, inserting and deleting records, all at record level. Concept Dynamics are selling it for \$99, on 0101 708 524 2814.

Stock Control

MISER is a stock control program. Not a fascinating area of programming, admittedly, but this program manages to do more than just produce reams of report printouts. It also graphs free stock over time, allowing users to play what-if games before they make any decisions. And it works out all the tough calculations on PCs scattered around the office, so it's a good example of distributed processing, too. MISER is available from Praxis Software on 0892 665821.

Blinking Updates

QBS Software are shipping new versions of their Clipper utilities, the FUNcky library, and Blinker, the fast linker. Both are compatible with Clipper 5.0, and Blinker is now allegedly even faster. Tel: 081 994 6477.

Virus writers eat children - official

More scary news from the Journal Most Likely To Keep You Awake At Nights, Virus Bulletin (0235 555139). Apparently, the Norton Anti-Virus, the new, massively hyped anti-virus utility, missed at least 11 of the most prevalent viruses. Plus, VB reports that a new strain of viruses is resisting all attempts to disassemble it. Moreover, an anonymous tipster on the VIRUS ECHO conference on Fidonet has asserted that this new virus is, in fact, a 'virtual living, breathing entity capable of teaching itself its pursuers' techniques'. What absolute nons-

Windows Fall Out

One of the odd side-effects of the Windows 3 bandwagon is that many old products are getting another go at becoming industry standards, while trustworthy classics are having to battle it out all over again. Precision Software's Superbase range of relational systems have done very nicely from the market shake-up. Never a leader in vanilla MS-DOS, its flagship, Superbase 4 for Windows, is currently selling as well as MS Word and Excel, and Precision has recently won a 200,000 order from the US Airforce. Time for the appearance of some third-party add-ons.

Live Link is a Windows dynamic link library that allows Superbase 4 users to insert real-time video-sequences into their database applications. All that needs to be done is to include a box of the required size in the form. Video-sequences can be seen live on the screen and then frozen before insertion into the database: they are stored as 16-bit TGA files. Digithurst's PB Card is needed for the frame capture. The system has a built-in control system using buttons to control freezing, saving and so on, or the functions can be accessed directly using Superbase's DML language. It costs £595. DaVinci, who manufacture Live Link, are on 081 200 5757.

Also available for Superbase is Bits Per Seconds' Chartbuilder package. Chartbuilder gets short shrift here as it is just a DPL port of BPS's Graphics Server, covered on page four. It is a bit cheaper, though: £145.

Benchmark for VGAs

New Dimension International Ltd have dropped into the public domain an impressive demonstration program for VGA systems. Primarily a plug for their Super-scape 3D graphics package, the company has added a continuous frames-per-second counter to make it into a handy VGA benchmark.

The program shows a three-dimensional IBM PC, complete with keyboard, being viciously bounced around a variety of ob-

jects (including some very large NDI logos). It's a shameless publicity stunt, I know, but the benchmark is as good as any, and it beats the Sieve of Erastophanes program for impressing the punters. New Dimension International can customise it to include your company logo, too. The Superscape Benchmark is available from NDI on 0734 810077.

Grind Grind Crash Bleep

A nightmare with a happy ending for users of SpinRite, the hard disk accelerator. SpinRite works by calculating the fastest interleave factor for your hard disk, then (harmlessly) reformatting the drive to this specification. The distributor, Riva, prides itself that SpinRite, despite all that hard disk crunching, has never harmed so much as a byte. It was, then, understandably horrified when a Mr Stafford Simmonds of Ayrshire phoned to say that his computer had hung up two hours into the operation, and had refused to budge since. After several long phone calls, Riva finally identified the problem as an obscure mismatch between Mr Simmonds' drive and his controller - a fault that could have caused a head-crash at any time, with loss of all data. SpinWrite spotted the problem (by crashing itself, admittedly) and was, therefore, the hero of the hour. Bet Riva was scared, though.

The new improved version of SpinWrite, V1.1, is now available from Riva on 0420 22666.

Poetry in Motion

WordPerfect's latest package is something rather odd. The company's called it 'Rhymer' - that's what it does, by God! The program is a TSR, in memory all the time. You hot-key on the word you want, it pops up with the rhyme.

Five-and-seventy British pounds is the retail price you'll pay. It runs on DOS computers. RAM needed? 30K. The Rhymer contains many words, but none to rhyme with 'orange'; which makes this story hard to end as (*Dan: finish this off please - W.*)

Optimising Turbo Pascal Compiler

Stony Brook, the Modula-2 people, has announced Pascal+, an optimising Pascal compiler that is completely source-code compatible with Turbo Pascal V5.5. The compiler, which costs \$250, produces code that is claimed to be at least 25% smaller than Turbo Pascal. The package includes a MAKE utility and a version of Stony Brook's Modula-2 debugger. Other boons are Windows support, an option to produce standard .OBJ files, and a version compiling to OS/2 later in the year. Stony Brook has not lost sight of their roots, however: Pascal+ was written in Modula-2, and supports Modula compiled routines. Stony Brook can be contacted on 0101 805 496. Real Time Associates are Stony Brook's agents in this country: they are on 081 656 7333/4/5.

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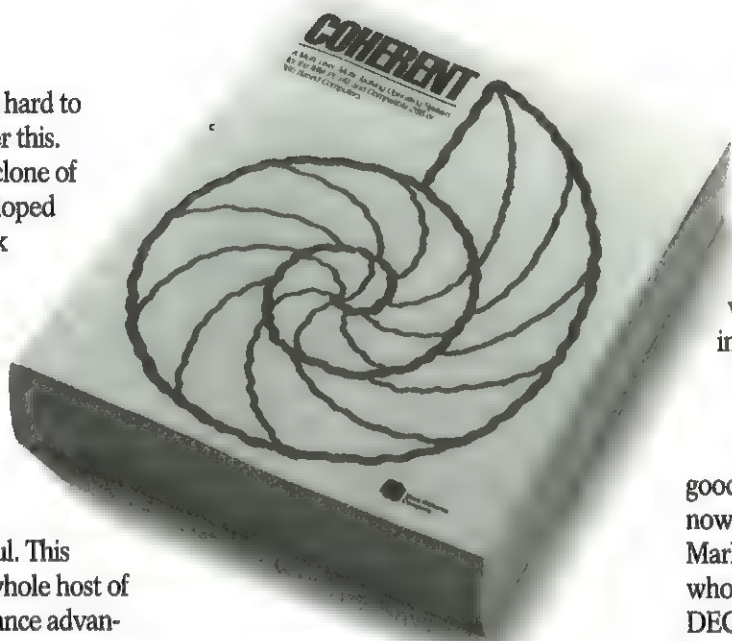
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*Byte Exec benchmark, 1000 iterations on 20 MHz 386.
Hardware requirements: 1.2 meg 5¼" or 1.4 meg 3½" floppy, and hard disk. SCSI device driver available soon. Does not run on Microchannel machines.

Letters

We welcome short letters on any subject that is relevant to software development. Please write to The Editor, .EXE Magazine, 10 Barley Mow Passage, Chiswick, London W4 4PH. Unless your letter is marked 'Not for Publication', it will be considered for inclusion on this page.

Prize winner

Sir,

It was with some interest that we at Cepro read Darrell Ince's item on NP-complete problems and his assertion that discovery of an algorithm for solving NP-complete problems would merit a Nobel prize!

At Cepro we have been working for some time with an algorithm which does just that for a wide range of NP-complete problems, eg Satisfiability, Chromatic numbering, scheduling and many Graph related problems. The algorithm runs in polynomial time and for almost all NP-complete problems runs very rapidly.

The algorithm, and its underlying mathematics, was discovered in Sweden. The first paper on applications of the algorithm will be given at Safecomp '90 at the end of October and the mathematics will probably be published next year. At Cepro, we are developing a range of tools for use in Safety Critical Systems development and also for scheduling applications. We have just released two tools onto the open market. One is for exploring Graph structures and the other is for modelling systems in propositional algebra. Both run on the Apple Macintosh platform.

If your readers would like any further information, we would be most happy to help.

Ken Wood
Managing Director
CEPRO

4GLs versus C++

Sir,

Congratulations to .EXE for allowing major space to those who would emulate the small boy watching the Emperor! Perhaps C has now taken enough of a bashing, but there is one point in relation to OOP that is worth making.

Providing an OOP language without excellent class library and environment support is, as John Daniels states, pretty useless. But the problem of providing general (across compiler) support at this

level is, due to the public domain nature of C, virtually impossible. Successful ones are going to be pretty 'proprietary'. This results in the worst of all worlds, a locked-in proprietary environment, and the dangerous closeness of C to the less civilised parts of the hardware.

Contrast the situation with 4GLs. They are cheerfully proprietary anyway, and are in business to make things easy for the developer. That means that they have a vested interest in providing good class libraries with meaningful source code for reassurance as well as reuse, if that's the way you want to do it. They also have a major design commitment to provide all the environment support and protection from the low-level errors that a compiled C application can commit, in order to allow the developer to concentrate on application logic, not system level mysteries. And don't tell me they are inherently slow - some are, but there are 4GLs and 4GLs.

If ever the problem of the DP department applications backlog is going to be cured it will be as a result of OOP. But not with C, or C++. Thankfully, 4GLs incorporating OOP will finally deserve the 4GL epithet, and we can then get on with the problem solving, as opposed to 'C'reation!

Chris Hibbert
DataFlex Product Manager
London

For the benefit of anybody who has not yet guessed it, 'DataFlex' is a 4GL with OOP extensions. Does anybody with a less partial background share this view of 4GLs as an alternative to C++?

Some BASIC notes

Sir,


I write regarding Andrew Duffin's excellent review of Spectra's PowerBASIC compiler (which is the package that supersedes Borland's defunct Turbo BASIC). I have just had the pleasure (?) of converting 2 MB of CHAINED Turbo BASIC source to run under PowerBASIC. I have found it an excellent product, and thought that the following points may be of interest to your readers:

- Conversion of Turbo BASIC code to run under PowerBASIC is simple, but a little tedious.
- For large projects PowerBASIC's capability to use batch files is **essential**. (Compiling 100+ BASIC programs 'manually', as required by Turbo BASIC, is **very boring**.)
- Data files are 100% compatible between Turbo BASIC and PowerBASIC. This eases the conversion of existing systems. As noted in the review, PowerBASIC requires much more free memory than Turbo BASIC. Spectra Tech Support can supply a utility called PBPLUS96 which 'grabs' 96 KB of RAM from your EGA/VGA card for use by the compiler. This utility is essential if you are developing large PowerBASIC programs.
- There are several known bugs in the standard issue compiler. Serious programmers should contact Spectra Technical Support to obtain a curative patch disk.
- Use the slower 8087 emulation package for 100% Turbo BASIC compatibility - the faster 'procedural' package can cause string comparisons to operate oddly.
- The documentation is excellent overall - what you need to know is contained in two clearly-written books - although the new 'unit' feature is written up incorrectly.
- Spectra Tech Support uses real people, not 'voice mail'.
- Surprisingly, the compiler runs out of memory sooner if you move code out of include files into separately compiled 'units'.
- The compiler can be purchased from some dealers for £75 rather than the £119.95 quoted in the review.

I have also tried Microsoft BASIC, but found it too incompatible. The documentation and software is voluminous but unfriendly. Does anyone purchase Microsoft products through personal choice, rather than corporate edict?

Richard Hathway
Earlsdon
Coventry

EXE



There must be an easier way to find information on your hard disk.

You know the information is there somewhere but just where? How do you find it when you can't remember what you called the file, or even which program you used to create it?

If this sounds familiar, you need Lotus Magellan – the most effective way to find, view and use the information in your PC.

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And the new version 2.0 offers an even wider range of features. To check for possible file corruption by viruses. To compress files and free more of your hard disk. To view an even wider range of files

(including the popular PIC and DRW graphics standards). To recover files already deleted.

Completely customisable, Magellan 2.0 now allows you to redefine function keys or create additional menu and help screens, to suit your personal way of working.

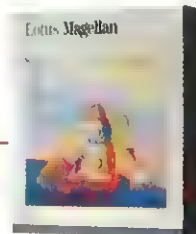
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Around the Table with Bjarne Stroustrup

When Bjarne Stroustrup, inventor of C++, came to London earlier this year, he found time to come and talk to .EXE Magazine.

Last December, .EXE Magazine printed an interview by Paul Smith with Dr Bjarne Stroustrup, inventor of the C++ programming language. This article generated more interest and comment than any other that we had printed. So when, earlier this year, AT&T UNIX Software Operation Europe told us that Dr Stroustrup was visiting London, and would we like to speak to him?, we jumped at the chance.

To make the most of the opportunity, we invited various C++ and OOP experts (many already familiar to .EXE readers) to come and quiz Dr S. The interview printed below consists of selected highlights from a round table Q&A session. Asking the questions were: Bryan Boreham, an experienced C++ user; Dag Brück, from the Department of Automatic Control, Lund Institute of Technology, Sweden; Richard Drake, from the London-based consultancy Objective Computer Systems; Neil Martin, a Senior Software Engineer at the BSI; Paul G Smith, a London-based technical journalist and consultant; and Steve Teale, a non London-based consultant, probably best known for his work on Zortech's C++ class libraries. Your Editor was also present as Chair, and to make sure that nobody swiped all the chocolate biscuits.

John Carolan [head of Glockenspiel] has suggested extending C++'s reach by means of extra classes, written within the constraints of the language, to appeal to markets such as BASIC, COBOL and the like. This seems a little far-fetched to me - what do you think?

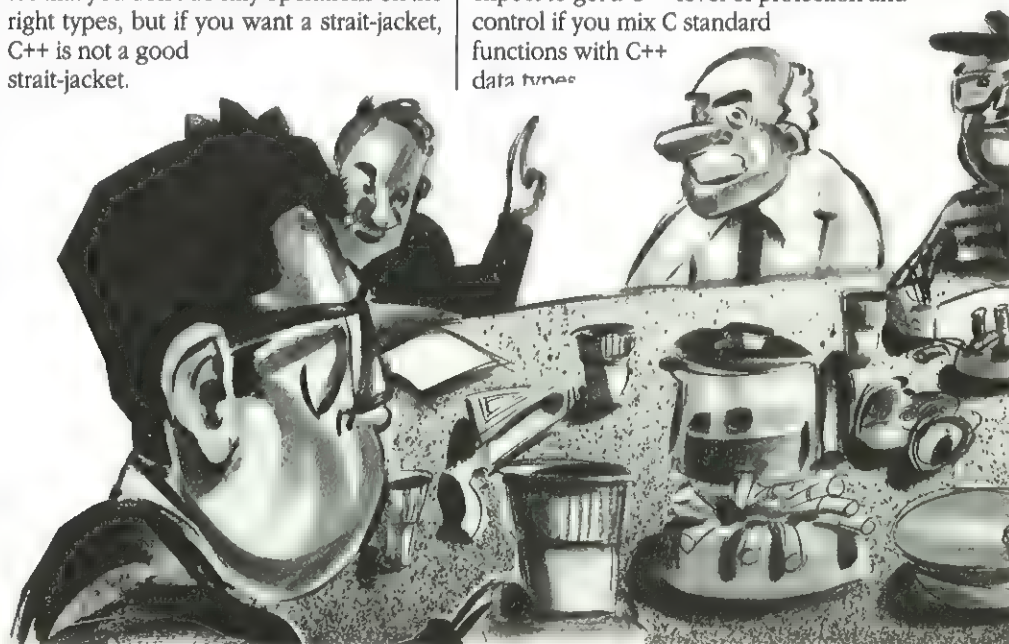
I don't know. We have done things along the lines of embedding the key notions of another programming language in C++. Somebody wrote a set of classes that implemented something that looked remarkably like APL. It had the fundamental APL vector type and some operators... They had to be named as functions, rather than APL operators, so that you could use an ordinary keyboard for writing programs that were essentially APL. APL is the right tool for some things, some brains just fit it.

Similarly, we do have *Awk* in C++, so that if you want to *Awk*-like things you can do it. The idea of building a library that provides all the fundamental notions and operations and data types of the language is there. You can simulate some of the syntax too, pro-

vided you fit into the general expression mode of C++. But if you want protection, so that you don't do anything else, that's probably too much to ask. You can guarantee that you don't do silly operations on the right types, but if you want a strait-jacket, C++ is not a good strait-jacket.

A lot of people try to implement a string type like BASIC's. Things start off nicely - you get your concatenating '+' and your stream I/O - but you come unstuck when you try to make it work together with C library functions. My favourite example is `fopen (path + name)`. It's very difficult to implement the operators to return and then a type conversion to `char *` such that you can keep control of the memory.

C++ strings and C strings are rather different beasts. A good C++ string hides its memory management. But the minute you start letting pointers leak into C, you get problems. You can assume that C doesn't do anything with them - but heaven help you if it does. You can pass a pointer to `printf()`, and if `printf()` just does the job and returns then everything is fine. If the function you call hides away or manipulates that pointer, all hell is let loose. So I don't think you can expect to get a C++ level of protection and control if you mix C standard functions with C++ data types.



But surely one of the prime goals of C++ was to retain its C compatibility?

Yes, but that doesn't mean that you can pass the data types across the interface and expect to get interested protection. C always relied on the user knowing exactly what he was doing. If I have a pointer to some data structure and I, as a C function, pass that to you, I am relying on you knowing my assumptions about the string and obeying them. You will have to make that kind of C-like assumption about the data structures if I pass a pointer to the C++ data structure to you as a C program. You are trying to squeeze C++ guarantees out of C. You can't do it. If you could, we wouldn't have had to build C++.

I think the ability to declare parameters as constant in external C declarations is a great help. I think in many of the common cases, like string functions, the constantness of a parameter to the C function is a guarantee that it won't do anything nasty to it.

I would disagree... in theory, the constant should be a guarantee, but in practice C doesn't protect you sufficiently. There's nothing stopping printf() writing over a constant. If you can trust your library supplier, you can trust the constant.

In the use of C you have to rely on trust. That is fundamental to C. But any language can only protect against accident, not against fraud.

You have been talking about this problem of mixing C with C++ but we are doing it every day, and it works. Yes, there is inconvenience, but, we have found in practice, the inconveniences are of lower magnitude than of using C on its own. That's the evidence. I have experience with hundreds of thousands of lines of code. It works every day. It works in research applications, it works in fairly ordinary applications, it works in life-critical operations.

Safety-critical

Do you think it's possible to produce C++ programs sufficiently type-secure that they can be used for safety-critical applications?

It is not the language's job to guarantee life-critical things. It is the *total* system that produces it, including the testing. The language provides a set of first-order guarantees against accidents. But if you write a life-critical operation, you should not be relying on a programming language for all your protection. I do not want a pace-maker from somebody who does. People who pretend that a language can guarantee correctness, and that you need

such guarantees of correctness from a language to do life-critical operations, are stupid and irresponsible.

Type-safe linking is an important plank of C++. Is it correct a lot of C++'s problems have sprung from making it compatible with the 1960s designed linkers?

The linker has provided a major constraint. It is a constraint imposed by the wish to run on a very large variety of systems. You must not design the language in such a way that you cannot run on those systems - replacing the linkers is the hardest thing. Providing your own linker means that you get trouble co-operating with other languages, including the one the operating system was in. I really didn't want to create a nice little C++ world, where everything had to be C++ and I had to write all the code from scratch. One of the first criteria for a useful language is that you can run it on the machine you want to run it on. Another is that you can share things with your friends, who can't all write in your language. So the linker *is* a constraint, but it follows from first-order criteria.

Name mangling

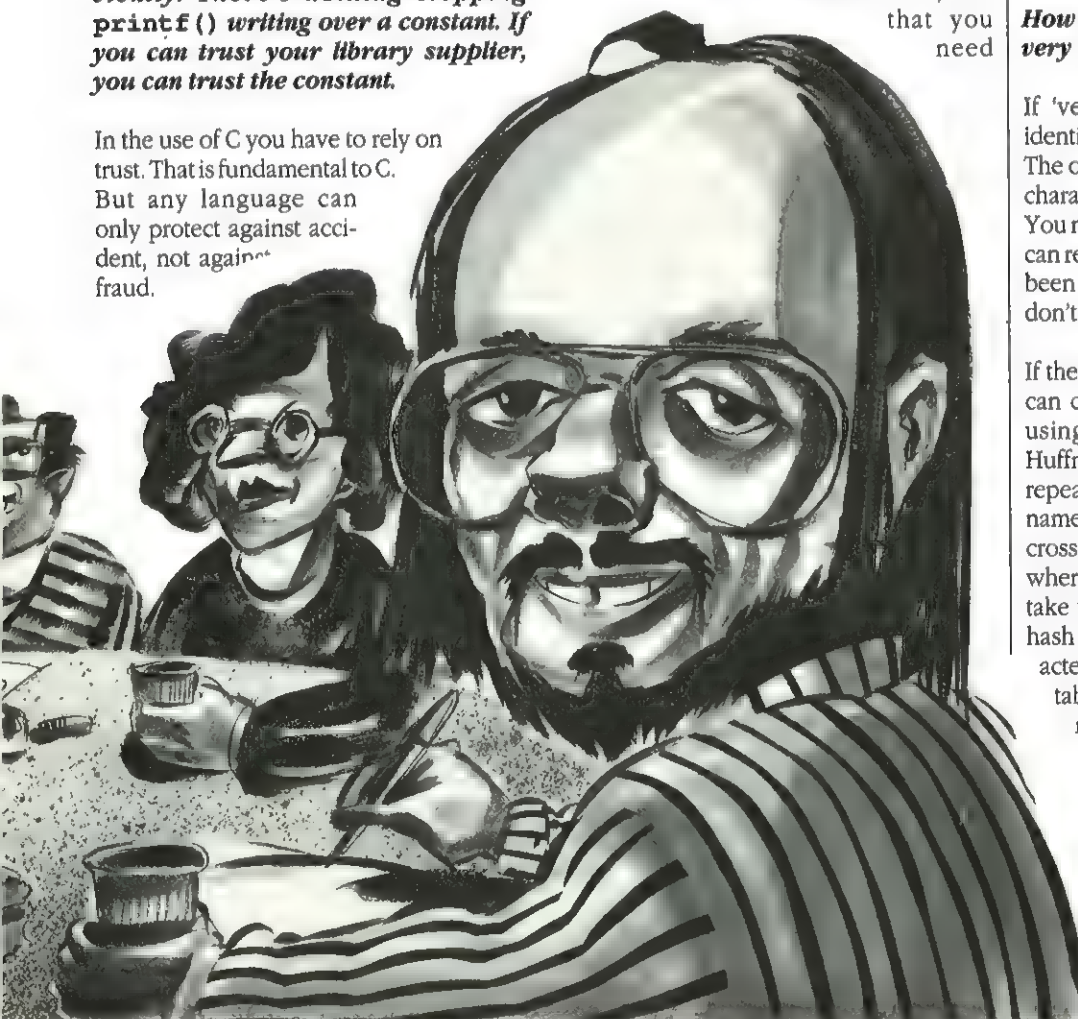
How do you handle linkers that have a very restricted memory?

If 'very restricted' means 'six character identifiers', then the answer is I don't.... The only way of managing with six or eight characters is to have a table look-up system. You need to keep a table around so that you can reverse the names again. I think that has been done for some IBM systems, but I don't know that for a fact.

If the maximum identifier length is 32, you can do a very good job. I mangle names using something that looks a bit like Huffman coding. It's a coding that uses repeating patterns, so you can cover most names even when you encode the types for cross-module typing. When you hit the case where the 'almost' isn't good enough, you take the last two characters and make it a hash code. Since we already have 30 characters significant, we don't need a reverse table for the hash coding, as first of all it's rare and second you can read the stuff anyway.

We notice that Zortech do name-mangling your way, the proper way, but Borland does it differently. Does it matter?

First of all, you use loaded vocabulary: 'the right way' and 'the wrong way'. If it works, it's the right way. I



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have no reason to believe that either Zortech or Borland did it the wrong way. I know that Zortech at least was thinking of doing it my way, because Walter [Bright] asked me what it was. But the layout of object code and the detailed functions of the linkers are not part of the standards. The standard prescribes what the source code should look like, and how separately compiled things may be bound together.

This has traditionally meant in C (or any other language) that you can only link things that are meant to be linked. You cannot link Zortech stuff with stuff compiled for a different CPU. That is clear. You cannot link the output of two PC C compilers, unless the two companies have decided to co-operate. Because there are different CPUs and operating systems, we can't get a global agreement. I therefore think that it does not belong in a national or international standard. If the suppliers of C and C++ on a given CPU decided to get together and do their users a favour it would be really nice. But somehow I find it hard to believe that Zortech, Borland, JPI and Microsoft would do it.

Can I ask you about the Object Management Group? What do you see as the role for groups like the OMG?

I was invited to give a talk on C++ at one OMG meeting, and I didn't know what the OMG was. I went, and gave that meeting, and came away still not knowing what the OMG was. It seemed to me that there were 40 or 50 people there, and at least 30 opinions about what the OMG was doing. Yes, they want standards, but I cannot quite see agreement within the people present about what they want the standards for. Nor what they should look like. So I have no opinions on what OMG is doing, because I can't figure out what that is.

The Standard

What do you think of the suggestion that C++ standardisation may be going ahead too early?

There are wild debates on what the ISO should and shouldn't do. It is very hard to know the right point to standardise. It seems clear that you don't want to standardise too early. You might get Ada. On the other hand, you have to have a process where users and purveyors of compilers can talk, otherwise, even if there were no ill will, you will end up with 10 dialects.

In some sense, C was standardised too late. By the time they standardised C there were already significant dialects. In several cases

they had to agree on a minimum specification, so that a dialect could persist. If you take the number of undefined and unspecified items in the ANSI C standard - I think the number is something in the region of 42

***We have a saying
in Denmark:
'Don't do what the
priest does, do
what he says'***

- and you take the number of plausible resolutions - call it 3 each - you find that there are something like 42^3 (or 3^{42} ?) plausible, strictly conforming ANSI C dialects. It would have been nice to have been able to avoid that.

You have a trade-off between getting enough experience and having so many implementations that they drift apart, even without ill will. I made a predication about standardisation of C++ could start and I actually picked a one year range. In fact, it happened to begin in roughly the first week of 'my' year, without those pushing for standardisation knowing my constraint. So yes, it has been pushed to the very early stages of what I thought was a suitable time frame.

On the other hand, nobody had predicted the growth in C++ and the diversity of implementations. We have worked for two years trying to create a good reference manual as a basis for standardisation we have got it. (Dr Stroustrup is referring to The Annotated C++ Reference Manual, by Margaret Ellis and Bjarne Stroustrup, published by Addison-Wesley, ISBN: 0-201-51459-1).

Do you think, given the problems that ISO had with C, that it is appropriate that there should be separate ANSI C++ and ISO C++ committees?

I believe that the way things are supposed to work is that the ISO sets up one national standards group to do the work on its behalf. I think that is what is going to be done. In that sense I think that the ANSI C++ group will be the ISO C++ group.

Speaking as a Dane, I don't think that the ANSI C committee considered European concerns enough - and some people won't like me saying that... We are trying rather

hard to make sure that it doesn't happen again. We have goodwill, and we have started early (not two years into the process) and we have tried to identify the practical problems. One problem was that, in many cases, the European comments on the ANSI drafts came in so late that the draft had been rewritten and re-approved in the next version before they arrived. That was one of the reasons that people took no action. I know that for C++ I don't want that effect. We are trying to organise things so that, on C++, a two months communications delay will become a three day delay.

What are you going to do about parameterised types?

We have got an experimental design for parameterised types now, and it is a good design. It will make the writing of container classes much more convenient and yes, I think it will be a great improvement.

William Cook was described as 'taking the acetylene torch to Eiffel' with his remarks at a recent conference about the difficulties you get into with parameterised types. Are you aware of those criticisms?

Yes, I am aware of that, and that's because I think that Eiffel's model of parameterised types is distinctly strange. If you look at the definition of parameterised types, you will find that the strangeness that William Cook 'torched' that day doesn't exist. You will find other things to take the torch to. But I am aware of parameterised types as they appear to Ada, Eiffel and a few others, and I don't think I have the first-order problems.

Will parameterised types and exception handling make it into the standard?

Yes. In the proposal to ANSI on what to standardise, those two features were explicitly mentioned as desirable. This means that we have to goof not to get them, and I have no plans on goofing. I have said for years that we ought to have them, and I happen to be the Chairman of the subcommittee in charge of getting them on board.

Playing with operators

C++ lets you define the actions of operators. When people start reading your book they think, 'That's great! We can do all kinds of things with this!' Later on they think, 'Hold on. I am going to be reading a program, and there's a '+' here, and I won't know what it does.' And all I ever see, in practice, is '+' and '-' implemented for complex

numbers, and matrices and things like that. What is your position?

The first thing is: people ought to be shy about it. If you read my book, long before any features are introduced, there is the most stern warning I could produce against jumping in and using all the features at once. I wrote that because I knew exactly what people were going to do, whether I gave a warning or not, so at least I would give the warning.

There is also a recommendation only to use operator overloading when there is a conventional use for it. Again, that's very hard to stick to - but when you stick to it you get something good. In cases like complex arithmetic, you have an obvious application. String manipulation is another one, with concatenation and subscribing. If you want subscribing, you don't want to have to write `index()`, you want `[]`. There is a range of areas where the technique is applicable. If you don't feel comfortable with it, don't use it.

So redefining old operators potentially creates confusion. What if you were allowed to define new operators?

My feeling was that allowing people to define their own operators would have some benefits, but you would certainly increase the obscurity of programs. What would 'twiddle, twiddle, bang' mean? I am sure it is very significant to the guy that defined the operator 'twiddle, twiddle, bang', but to the reader it would be obscure. The number of uses where I could see a real improvement seemed rather low, and the increase in complexity of the language was definite, so the trade-off looked right.

There have been several suggestions that we could define our operators with names: that we could write, for instance, a `mul b`. The problem is that you have to be able to specify the precedence and associativity of `mul`. I didn't feel like doing that. It's a case where yes, it can be done; but you tell me something that you absolutely need it for, and I'll consider it.

People had very good arguments for overloading of the normal operators. The obscurity you can create with this facility was high, but limited compared to the possibilities if you could define 'twiddle, twiddle, bang'. That was the trade-off.

If they could, what operators would people like to invent? Based on experience, the first one they invent is, of course, `***`. There exist legal uses of this in C, so it would be

an added C incompatibility if we did it. Also, the way they want to define `***` [as a 'raised to the power' operator] is really for the built-in operators. In other words, it is not really my job, because it is to do with the standard data types. If they wanted a `***`

It seems clear that you don't want to standardise too early. You might get Ada

operator, it should have been the ANSI committee that invented it, not me. And then there are the other good ones they want to invent, like `/'/'` or funny division. The point is that the top suggestions for desirable user-defined operators happen to be trouble-makers. Which means that if you have them, I also have to implement very, very clever error handling to prevent ambiguity.

In view of this philosophy of only overloading operators intuitively, how do you explain the first example in your book, which shows an overloaded Left Shift << operator acting as a stream operator?

Good question. We have a saying in Denmark: 'Don't do what the priest does, do what the priest says.'

I find that the C++ stream I/O doesn't provide the formatting that you need for writing serious applications. Do you agree?

I think the concept of the stream is too underdeveloped. I think we very badly need a system that allowed a uniform mechanism for I/O of both user-defined and built-in types. I thought that the absolute distinction between the types you defined and the types Dennis [Ritchie] defined in `printf()` was unacceptable. I was trying to create a mechanism that allowed that distinction to vanish. The fact that the system has been developed without sufficiently good formatting functions I think is just immaturity. There is a model, and it works well for a lot of cases and it can be developed further.

I think it ought to be developed further, because we are trying to eliminate distinctions between my types and your types, and we cannot make that elimination without taking into account I/O. A lot of languages that provide data abstraction break down totally at the point of I/O, because the I/O is focused exclusively on built in types. That's why I went to stream I/O.

My first attempt used function names like `put()`. I tended to call them several times, with a set of parenthesis that made it look a bit like LISP. I recoiled, and did the `<<` trick instead. We can have a nice argument about whether I should have done it or not. There's no doubt that I violated my own rule for when to use operator overloading.

Up scope

Here's one C++ feature that annoys me. If you have a set of overloaded functions in a class, and then you derive a subclass and redefine one variant, it masks all the others. Why?

That's a necessary consequence of normal scope rules. You don't have overloading in cross scopes. The definition of a name at a certain scope hides any previous definitions of that name.

This scope business always throws me...

The scope of the derived class is enclosed in the scope of its base class. You look in the local scope, and if you don't find it you look in the enclosing scope.... I mean, you can imagine overloading a global function `f(char)`. Now, inside a function, you define `f(int)`. Can you now get overloading resolutions on `f(int)` and `f(char)`, or can you only see `f(int)`? The answer is you can only see the local one. This is the same rule that applies throughout.

The question is: should we have special rules for the overloading of functions. I think not, because you can get very strange situations. The best example would be an assignment operator. Say you had a base class, and you had assignment of an `int` defined for it. Now you derive from it. Can you assign an `int` to an object on the derived class? No, because you have the default assignment for the derived class, and that hides the assignment of `int`. If it was not so, you would have an assignment where you suddenly assign on part of an object, ignoring the rest.

And so we have a general rule that's logical and applied throughout the language. It

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gives some abnormalities, but if we introduce a special rule that resolves it, we get another set of abnormalities. In that case I stick with the general rule.

What about a way to specify some functions to bring down?

Yes, I have done a fair amount of thinking about that, and I haven't got any really good solutions. What I am doing with Cfront [the AT&T C++ compiler] is making it very good at looking at a definition of a virtual function, and then checking to see if you have forgotten to bring some up, and warn you. So if you have a base class with `f(int)` and a derived class with `f(char)`, and if it's virtual, it will ask you: do you really mean this? The likelihood is about nil. So I am working to make sure that the mistakes will be caught. But not by making them impossible, or by redefining the language so that they magically become legal.

Have you heard the comment that, when you start writing large C++ systems, the make file is more complicated than the program, and is more

difficult to write

I have stopped talking about smart make. I want a dependency analyser that can hook up an incremental compiler, so that we don't get that cascading of recompilation. And like other things with C++, I am not going to get it for Christmas. But eventually I'm going to get it...

Personal concerns

You have been involved in C++ for many years now. How long do you see your personal involvement continuing at this sort of intensity?

I have kept saying for a lot of years: just another year, no longer. I don't see why anybody should believe me. I am trying to do other things, but it's so hard. Things come along that need to be done and hopefully when all the things that need to be done are done I should be able to get some fun. It took two years to write the reference manual, and that's not fun work. The only thing that's worse than reading a reference manual is writing one.

And I don't know, I hope I'll get some of the more interesting parts. But, for instance, there's the pressure of getting parameterised types and exception handling. Since everybody knew it was needed, and I had acknowledged the need, it more or less ended up in an obligation for me to put up a good design. Now I have done that, and now people are after me, wanting to know when I can get it running. It isn't easy.

Are you still interested in what you do, or is C++ just becoming a drudge?

Some of the things are interesting. The design of the exception handling schemes was quite a challenge. I think we have a very good design now. That was interesting.

EXE

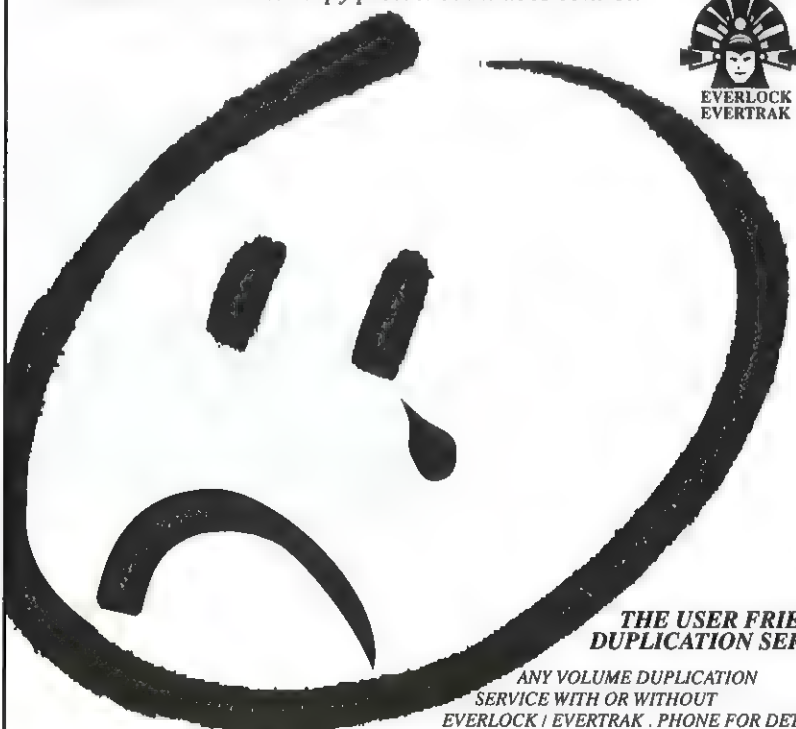
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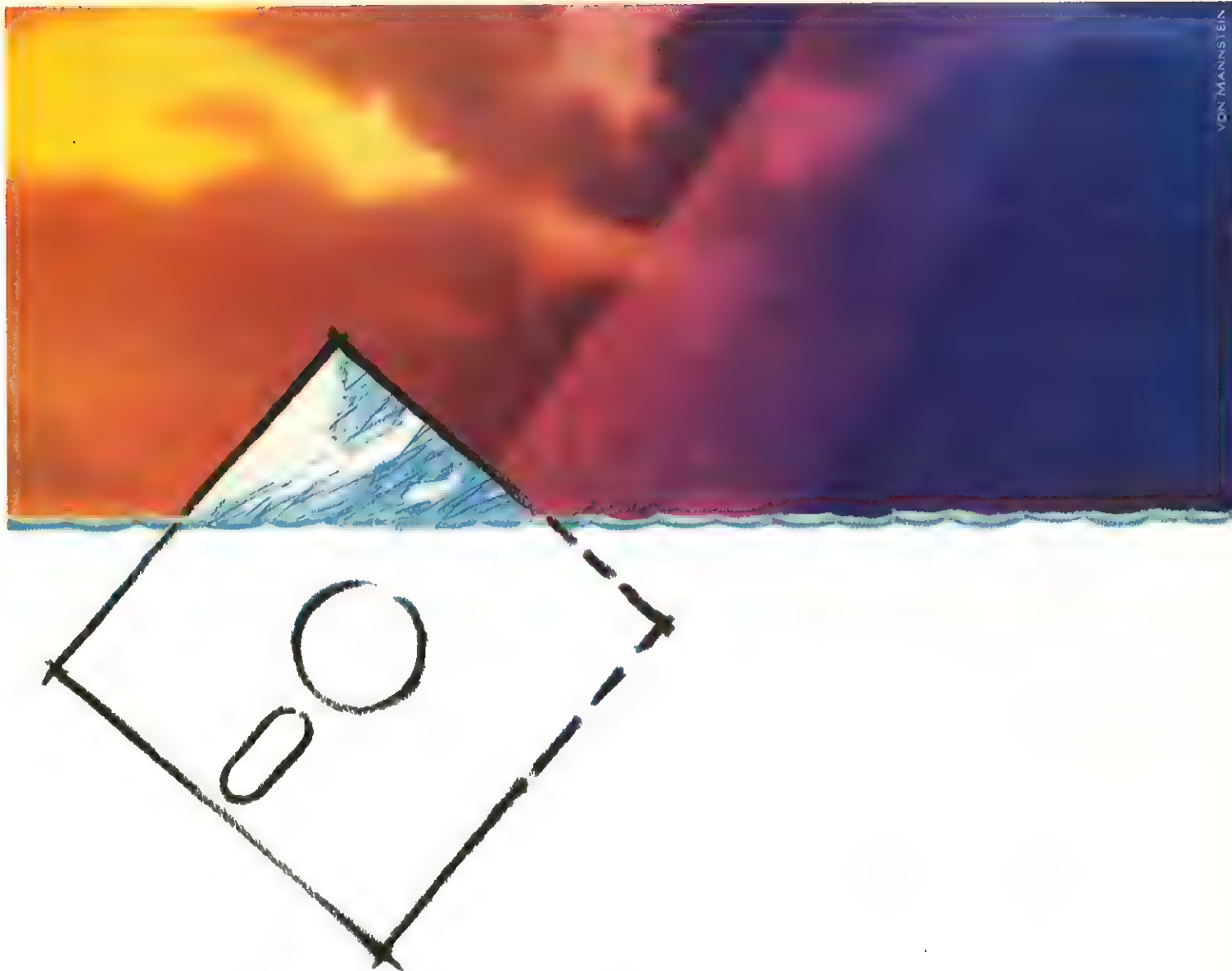
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CIRCLE NO. 315

A Flare for the Dramatic - Actor V3.0

The advent of Windows 3 has been heralded as the evolution of the IBM world into a mature GUI-based system. Programmers need to produce Windows software quickly and reliably, Actor V3.0 is one tool that gives you that power.

For many people, Windows is now beginning to look like a practical system. Previously, developing sophisticated multi-window applications inside 640 KB was just too much work. For others, the benefits of object-oriented programming was similarly a peripheral issue; discussed but not used. A third group, however, has for some time known and used a combination of sophisticated windowing software and an object-oriented development platform - Actor.

As time passes, programmers struggle against increasing complexity of both the programming environment and the code that they are producing. This has never been more true than today, with the emergence of windowing systems as a basic standard. Many a C programmer must have wished for a return to the quick, straightforward 'Hello World' approach to programming. Have you tried displaying 'Hello World' in a Windows window using C and the SDK? It's no small task. The Actor equivalent, on the other hand, takes all of three lines. It is shown in Figure 1.

The Stage

Actor is a single-inheritance object-oriented language. As with any object-oriented language, the act of programming is about creating instances of classes. Classes can have instance and class variables and a set of class and instance methods - no surprises

here. Unlike the purest OOP setups, there are `if ... then ... else`, `select`, and `loop while ... begin` structures.

***The browser is
less sophisticated
than its
Smalltalk
ancestor, having
no class and
method categories***

Actor provides full, thought-out access to DOS and the BIOS. A CStruct class allows programmers to define complex objects for communicating with C code via the DLL interface, using familiar C structure definitions. You can even define your own 'primitives'. These are methods written in optimised assembly language.

So, as you can see, the system supports a wide range of levels of abstraction, starting from assembler, through BIOS and DOS calls to C libraries, to simple basic classes,

to Windows functions, to abstract class libraries. There are few development systems that could hope to rival such flexibility.

The Play

The system is distributed on both four 5.25 inch 360 KB disks and two 3.5 inch (two 720 KB disks). Its minimum requirement is an ordinary PC/XT with graphics card and 640 KB, but it won't be much fun on less than a 286 with at least 1 MB. There is a simple, non-Windows installation program, which asks for the target directory and unpacks the files from the disks (to reduce the number of distribution diskettes, and in line with current common practice, ZOO archives are used on the distribution disks).

Actor's programming environment is sophisticated and shamelessly borrows many features from Smalltalk. For example, as with Smalltalk, the system saves the complete programming environment (with all the global variables, open windows etc) in an image, to be restored when the image file is next loaded. This contrasts with conventional programming systems, such as interpretive BASIC, where only program text is saved from the environment. As with Smalltalk, this high degree of integration of program with environment complicates the business of creating stand-alone applications.

```
MyWindow := defaultNew(EditWindow, "Simplicity");  
show(MyWindow, 1);  
writeString(MyWindow, "Hello World");
```

Figure 1 - Actor Version of 'Hello World'

Figure 2 shows a typical Actor screen (note that it doesn't use the MDI guide-lines). Open windows include the browser, an inspector, the workspace, a debugger and the Actor Display (the parent window).

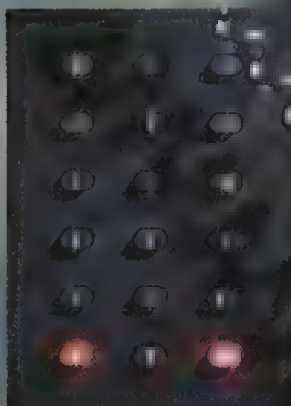
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Browser

The browser is perhaps the most used tool. It allows the class hierarchies, variables and methods to be displayed, examined and altered. Classes can be arranged either alphabetically or hierarchically. It is somewhat less sophisticated than its Smalltalk ancestor, having no class and method categories. These were merely organisational aids, but I miss them! Selecting a class name automatically updates the related windows in the browser, displaying the instance and class variables and the methods. Selecting a method brings its source code up in the editing window, where it may be amended and then 'Accepted' or abandoned (you cannot leave the system or inspect another class without doing one of these - but you can, however, have multiple browsers).

Inspectors can be invoked for any selected object, and allows the contents of that object to be examined and changed. They are especially useful for complex objects, where separate inspectors can be created to view sub-components.

The debugger allows you to inspect program execution via an execution stack. The stack displays the current messages, you can select the point at which you wish to check the program flow. Selecting an item in the execution stack displays the method (Smalltalk also highlighted the point which the method had reached, I really miss that) and the variables. You can inspect, change and resume execution from any point in the stack.

The other two windows are the Workspace and the Actor Display. The former contains

the menus and invokes the various tools and allows the programmer to try out messages in a quick and usually dirty fashion. The Display lets you switch between windows and seal off applications ('sealing off' is the process of creating stand-alone .EXE files).

Actor is now a mature development system, with years of experience behind it

There are two other tools that are not in everyday use. Once an application is ready, there is a simple profiler that can tell the programmer which methods are called and how often, enabling him to carry out selective optimisation if required. For the really keen, there is also a low-level debugger. This only works with sealed off applications, and is operated via a terminal connected to a comms port. It then proceeds to fill the screen with meaningful data about program execution (says the manual) - my experience suggested that this tool was strictly for real programmers only!

Classes

One criticism of many current object-oriented products is the lack of class libraries. Not a complaint against Actor. The basic system comes with an extensive set of classes, including Collections, Windows support, example applications, and many more. Two 'bonus' class categories supplied with the basic system illustrate the careful attention that has been paid to classes.

The YaccMachine and Parse classes allow you to define your own specialised language for applications. A Turtle language grammar specification is included as an example. To use this feature properly, however, it is necessary to have access to a yacc (to generate the grammar state tables in C) and nearly essential to have access to awk (for converting the yacc output to Actor format).

There is also a set of classes supporting 'Frames'. There are three core classes: Frame (a dictionary of Slot objects), Slot (a dictionary of facets - #value, #default etc) and FrameList (a dictionary of all frames used in an application). They support AKO (a-kind-of) relations and the algorithm for answering questions (using the chain of AKOs and rules for defaults etc) is sophisticated, and can be tailored if required. There are even detailed suggestions for extending the power of these classes.

However, as anyone who has been involved in developing a set of general purpose classes will know, it can be hard work finding the right ground between abstraction and utility. Whitewater has taken the horse by the mouth (*sic*) and produced a really comprehensive and easy-to-use set of graphics classes, called *ObjectGraphics*. These are sold separately to Actor, but should really be considered as an essential for anyone considering graphics work. Indeed, the ability to use these classes could be considered the biggest improvement between V2.0 and V3.0 of Actor.

ObjectGraphics offers a wide variety of sophisticated 2D graphics facilities. There is a large scale program, in sealed off form (OBJDRAW.EXE and an image OBJDRAW.IMA) with the class library. ObjectGraphics changes some of the existing Actor classes as well as adding new ones. The manual is at pains to show just what classes are affected (to avoid inadvertently destroying any work you have done if you are loading into anything other than a virgin image). To use these classes ACTOR.EXE must also be modified using the resource compiler, RC.EXE (supplied with Actor and

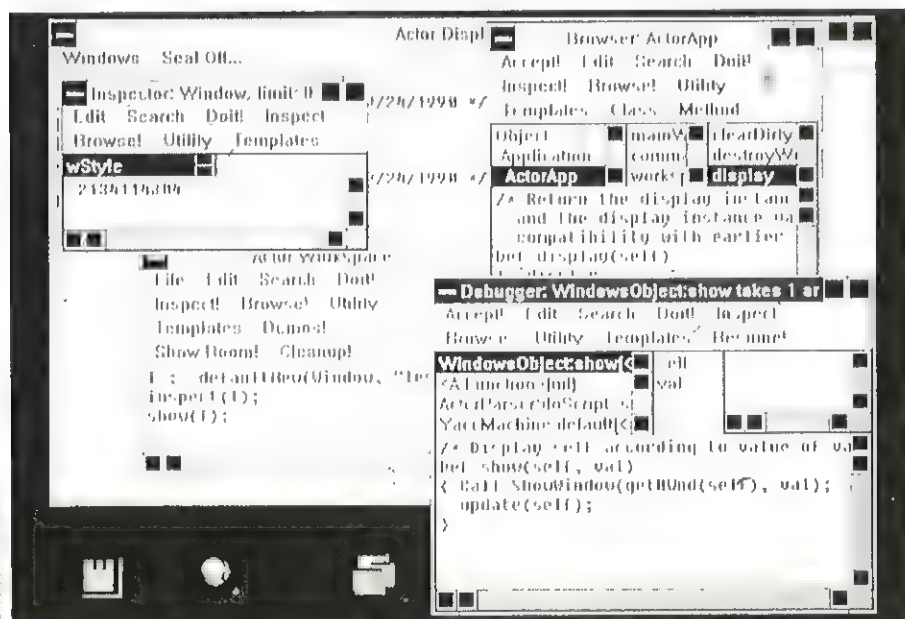


Figure 2 - Actor in Use

in the RES directory after installation) to include the additional resources required. Then simply load the files in the OGX.LOD file (using the load("ogx.lod") message).

The example program has a dual role. First, and most obviously it is an extended, sophisticated example that uses nearly all the ObjectGraphics classes. The manual suggests that, by extending the program with your own additions, you can use it as a test platform. It is also a 'screen painter': you can draw up a screen with sophisticated graphics and custom shaped 'button' objects and import the result into your applications. Your programs can manipulate the graphical objects that constitute the picture (eg perform hit checks). This saves a lot of time and code - it is even possible for non-programmers to create screens. The system is flexible (screen appearance can easily be changed) and is very simple to use, but loses none of the power required by programmers. Additionally Whitewater claims that programs developed in Actor based on ObjectGraphic's classes will be portable across other 'supported platforms' (ie OS/2

PM soon-ish, and possibly, one day, the Macintosh).

How does ObjectGraphics approach the problem of portability across windowing

The upgrade from Actor V2.0 to V3.0 was not as revolutionary as the upgrade in Windows itself

platforms? With *rendering tools, platform filters (or 'ports')* and *graphics*. Rendering tools control text (font, size and style), line width, colour, and so on. All graphics ob-

jects use rendering tools to draw themselves. A 'Port' is the generic output device (eg a printer, a Windows window or a PM window). Graphic objects are the things that render themselves within ports using rendering tools.

A Doodle-type sample program, called SampleDraw, provides example use of the 30 new classes, and gets the programmer into ObjectGraphics straight away. The manual invites you to change the sample program to manipulate other objects. This really showed the power of the classes: it was possible to modify the program (which, as supplied, only drew lines) to support ellipses, rounded rectangles, rectangles and pies. All the new shapes inherited the existing width and colour options. The complete program contained no more than a handful of lines of code, and I completed the modifications to support the extra shapes in a matter of minutes. Figure 3 shows a code fragment which allows the operator to draw a shape by 'dragging' it on the screen. The sequence illustrates the handling of three messages: beginDrag, drag and endDrag.

Documentation

The quality of the manuals is very high, with pathways for both experienced and new Actor programmers. There are sections on what object-oriented programming is, and how to do simple object-oriented design. There is an early focus on the typical Actor development cycle (to familiarise the programmer with the tools). Smalltalk programmers who have bother to read these early sections will experience a sense of *déjà vu* - the examples, business chart and account browser seem to come straight from the Orange Book. The manual goes into great detail about Windows resources and their creation, whether with RC, dynamically or the Whitewater Resource Construction Set (which was itself written in Actor). Each of the major classes is introduced. The documentation then treats the Windows objects in detail, and also covers the sealing off process (creating .EXEs) and project management. The manuals are more than a tutorial - they are also an excellent reference for the experienced user.

Problems

The system is not perfect. It lacks the more sophisticated browser from the Smalltalk environment. Surely, more than 10 years on, it should be possible to do *better* than the basic Smalltalk tool set. Under earlier versions of Windows,

```
/* Build and draw the initial shape, and prepare for
   rubber-banding.
*/
Def beginDrag(self, keyStates, aPoint)
{
  select
  case currentShape == #Line
  is theShape := build(Line, aPoint, aPoint);
  endCase
  case currentShape == #Circle
  is theShape := build(Ellipse, aPoint, aPoint);
  endCase
  . more of the same for Box, Rounded Rectangle and Pie
endSelect;
setPen(theShape, build(Pen, color(RGBBox), #solid, 1, #nxor,
#opaque));
associate(port, self);
draw(theShape, port);
}

/* Perform rubber-banding of shape.
*/
Def drag(self, keyStates, aPoint)
{
  fastDraw(theShape, port);
  setCorner(theShape, aPoint);
  fastDraw(theShape, port);
}

/* Draw shape in final position and add to picture.
*/
Def endDrag(self, keyStates, aPoint)
{
  setPen(theShape, build(Pen, color(RGBBox), #solid,
width, #copy, #opaque));
add(picture, theShape);
draw(theShape, port);
dissociate(port);
}
```

Figure 3 - Extending the SampleDraw Utility

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```

/* this creates the extended SampleDraw menus */
Def buildMenu(self | m1 a1 a2 a3 a4 a5 a6 a7 a8 p1)
{
    m1 := create(new(Menu), self);
    a1 := new(MenuItem, "&Width!", 100, #width);

    .      and so on creating other menus here

    a7 := new(MenuItem, "&Pie", 106, #pie);
    addItem(p1, a3);

    .      add other menu items to parent / popups

    addItem(m1, p1);
    drawMenu(self);
}

```

Figure 4 - Building Windows menus Interactively

it was not possible to clutter up the browser with classes (there simply wasn't enough memory). Now it is different. Some class categories, or some more advanced method, are desirable. Project filters (allowing only certain classes to be viewed within a specified project) would be helpful, as would be the ability to allocate classes to projects dynamically. The manual should stress the role of project support in the environment more, as a class librarian is essential in any OOP based project.

The memory management scheme is still a little strange. Could we not just have a single homogeneous 16 MB address space? Neow (UK distributor) says that the forthcoming '32-bit kernel' will address this problem - but perhaps only for the OS/2 PM version.

The installation program should be Windows-based (I don't want to be reminded that MS-DOS exists). However, it is very painless and certainly one of the better examples of the variety.

Does Actor replace the Windows SDK? Not completely. There is not enough detailed explanation of Windows internals

***I am sure that,
as time passes,
Actor will be
seen more and
more as a
mainstream
development tool***

to be able to create novel combinations of existing Windows features. Two examples spring to mind. The MDI interface is men-

tioned only briefly; the Actor developer is referred to the SDK for more information. The support for DDE is primitive. It would be very difficult to improve this state of affairs without more extensive Windows reference. Whitewater is reputedly able to supply some classes on the understanding that they are not officially supported yet - (available 'real soon now').

The Actor system does not stand alone. Whitewater has provided a full set of complementary tools. The ObjectGraphics tool, discussed above, allows complex graphics to be defined and used in programs. A Resource Toolkit aids the creation of dialog boxes, bitmaps etc. For database programmers, there is Wintrieve, an ISAM file manager which acts as a server for multiple applications offering unlimited numbers of indexes for each file. All code produced by these tools can be included royalty-free with your program.

Conclusion

I believe that Actor can contribute effectively in four main areas. It features prominently in many large corporations programming efforts (Whitewater claims to have developed it as a product suitable for Fortune 100 companies). Like Smalltalk, it is ideal for rapid prototyping. However, it is clearly designed to produce 'real' programs. I am sure that, as time passes, it will be seen more and more as a mainstream development tool, especially in the hands of those writing for vertical markets. There is another role for Actor: it is a wonderful vehicle for those wishing to learn Windows. The interactive environment makes it an ideal way of experimenting with the system.

There are many other Actor features that I have not mentioned. It is apparent that Actor is mature, extensible and up to the task - it could be said to be in a class of its own (geddit). If you need to do Windows programming, I believe that there has never been a better time or a better way! If you are not doing Windows programming, why not?

EXE

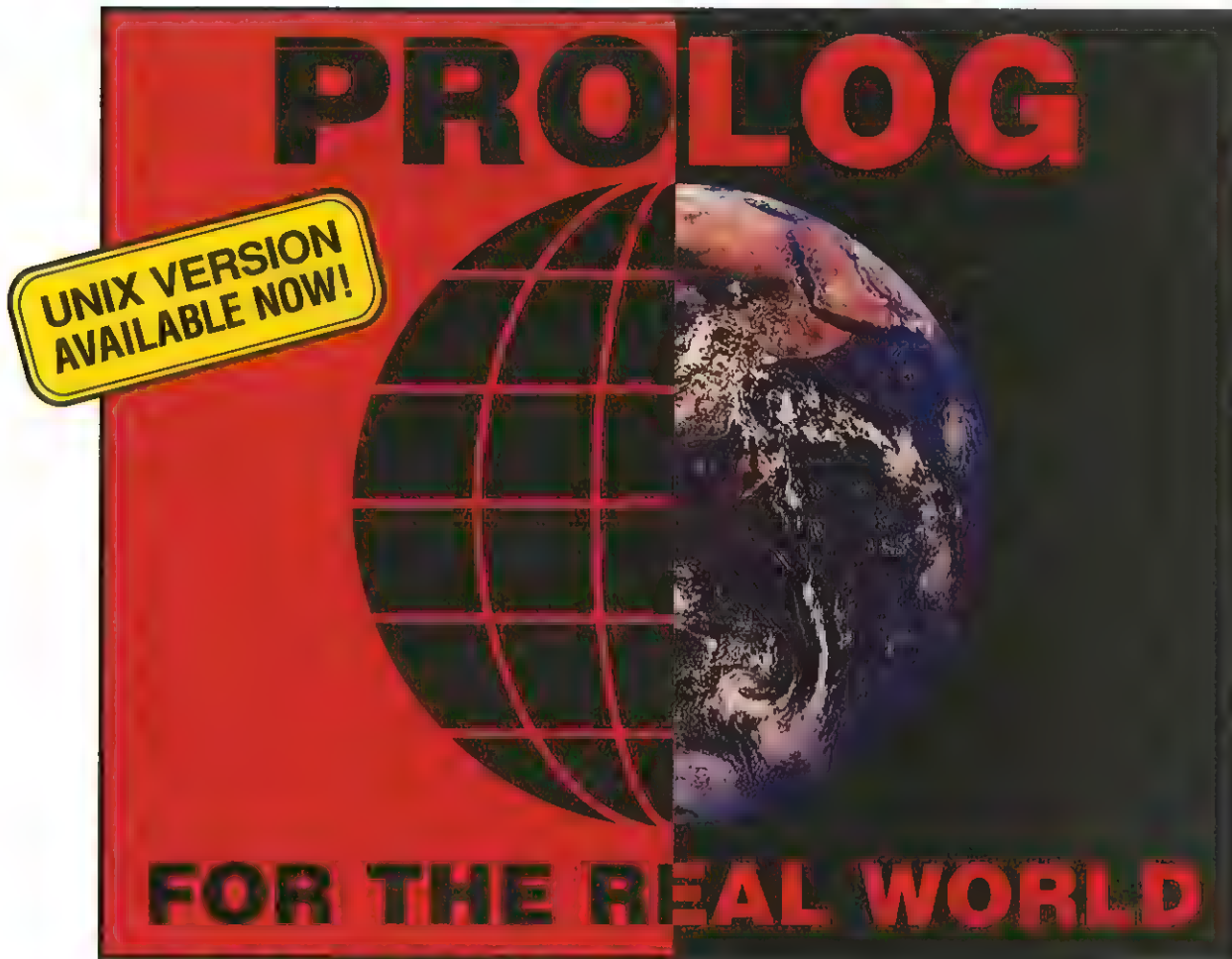
V3.0 upgrade

Whitewater, Actor's manufacturer, introduced V1.0 as far back as 1985 and, despite problems (V1.2 had only 70 KB - 80 KB available for application code), has ended up with a sophisticated and mature development system. The upgrade from Actor V2.0 to V3.0 was not as revolutionary as the upgrade in Windows itself. Whitewater overcame the code space problems in V1.2 by introducing memory swapping scheme for V2.0. This remains in V3.0, but can use real memory (as opposed to disk) and consequently is much faster. Disk-based code swapping can still be invoked if only 640 KB is available. The new version can use the whole 16 MB Windows memory for storing objects (bit maps etc). There is now a full 1 MB of space available for static and dynamic memory respectively, allowing programs up to 2 MB in size. (Static memory is the memory used by the class definitions - the code you write. Dynamic memory is used by the objects you create inside the programming environment and the objects your program creates while running.)

The class library has also been upgraded to cope with the new Windows features (combo boxes, high-level support for hierarchical menus and the ability to run multiple Actor sessions simultaneously). Figure 4 shows a fragment of code to build menus dynamically (ie not defined in a resource). The manuals have also been rewritten, improving an already high standard.

Joe Borkoles is a Research Scientist at the HCI Group, Queen Mary and Westfield College, London University. He has himself used Actor in anger, while developing a multi-media training package. Thanks to Neow (06286 68334) for supplying the review copies of Actor V3.0 and ObjectGraphics. Prices are £545 for Actor V3.0 and £295 for ObjectGraphics.

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Microsoft Speaks!

C++ is the language of the moment. Yet the biggest player in the arena is conspicuously absent. Microsoft's Andrew King explains what's up.

Programming is in a state of flux. Application development is moving from character-based to GUI environments, from single-tasking to multi-tasking systems, from isolated to client-server architectures, from procedural to object-oriented programming, and from C to C++. The decisions that vendors make now will define programming for the next decade.

It is for this reason that Microsoft is committed to working through the many issues involved, and delivering a high-quality C++ professional development system. Microsoft is currently developing a C++ professional development system that is a superset of C++ release 2.1. This product will be offered as an upgrade to existing C customers.

Development Issues

Microsoft pioneered several language features that are now part of every personal computer C compiler - for example, the near, far, and huge keywords for manipulating data in the segmented architecture of the Intel family of microprocessors. Microsoft's C++ team in Redmond recognise that several issues are crucial to the development of a reliable and productivity enhancing C++ product.

Most important is the coexistence of C++ and C. Because C has become the standard programming tool for many of the PC industry's leading developers, it is critical that C and C++ code coexist. The huge investments already made in the production of existing C code must not be wasted. Modules written in C must be able to use, and be used by, modules written in C++. Microsoft is committed to supporting this coexistence.

Portability between languages is another vital issue. Over the last few years, Microsoft has built a family of interconnected development tools: from the Programmers WorkBench, through inter-language calling, to common tools such as the CodeView debugger, Microsoft has enabled developers to select the language best suited for

their particular task. The logical extension of inter-language calling is the ability to create and work with object libraries in various languages, whether C++, Object Pascal or other languages that acquire object-oriented extensions. Careful design and implementation of the manner in which code and data are accessed, the object model, is imperative. Without this, developers who select one language over another might well be stranded in a dead-end solution.

***Microsoft hasn't
rushed into C++
because it wants
to be the most
innovative AND
the most reliable***

Microsoft has recognised that application development under object-oriented systems has been held back because of the high memory overhead and general poor performance of the systems themselves. Implementation efficiency is thus one of the most pressing issues facing developers of C++ compilers. Microsoft's goal is to improve the execution performance of the AT&T object model until C++ execution times are as close to C as possible. Anything less, developers will be hesitant to move their current C-based projects to C++.

One area of opportunity in object-oriented programming is the class library. Two types of class libraries dominate the market: 'wrapper' classes and 'true object' classes.

Wrapper classes are typically created from existing C libraries; either standard ones that are supplied with the compiler, or specialised libraries from third party vendors. Wrapper classes are a convenient way to provide C++ functionality, bundling the data and prescribed

functions into a class. A wrapper class for an existing application programming interface (API), such as the OS/2 operating system API, would be an example of this kind of library.

True object libraries are engineered as object libraries from the bottom up. Unlike wrapper-class libraries, these facilitate the creation of applications that benefit from data abstraction, inheritance and flexibility provided by C++. Well-designed object libraries, providing a high level of abstraction, portability and reusability, will play an increasingly important role in application development, especially for graphical environments. Building these classes is one of the greatest challenges facing the C++ community.

Microsoft is developing both object libraries and wrapper-class libraries, with a focus on the design and implementation of object libraries for graphical environments. Graphical environments are well suited to the principles of object-oriented design and are inherently message driven. Microsoft will provide wrapper classes, as appropriate, to allow C++ programmers access to the system-level functionality they have grown accustomed to using.

The potential exists for confusion between these two types of libraries. Customers who purchase a C++ 'class library' that is marketed as an 'object library' may be disappointed to learn that the library is nothing more than wrapper classes. Library vendors have the responsibility to make the distinction clear.

Systems Software

Microsoft Windows and OS/2 Presentation Manager lend themselves to object-oriented programming. The importance of C++ to Microsoft is underlined by the fact that object-oriented development straddles both the languages group and the operating systems group in Redmond. The graphical environments preceded the popularity of serious object-oriented languages and were programmed using tradi-

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tional procedural methods. Therefore, as object-oriented languages evolve, it makes sense to reassess the way programmers access systems software platforms. The object-oriented systems technology at Microsoft consists of three modules: building the infrastructure, programming support, and user interface tools.

With traditional PC programming languages, the object .OBJ (not to be confused with objects) was defined. Analogously, for C++ and other object-oriented languages, Microsoft will define a common model for storing objects (OOP objects) in the system, and mechanisms for accessing system objects. This common object model will allow multiple languages, tools and libraries all to work together. The object model defines the way objects are accessed by the system and user programs. The design and definition of the object model is the foundation upon which everything else is built. Microsoft's common object model has two significant components - the abstract object model and the runtime object model.

The abstract object model provides the protocols for handling objects within the system. It consists of two managers: the abstract object manager and the system ob-

ject manager. The abstract manager provides an environment-independent way for objects to be used by the system. This provides an abstract protocol for managing objects, eliminates the need for abstract objects to be aware of their environment, and allows objects to be shared between applications. The system object manager defines the low-level operational aspects of dealing with objects. It allows protocols and mechanisms to support persistent objects and object sharing between processes, applications, languages and even vendors.

The run-time object manager handles how objects are used at execution time. This handling is highly efficient, and optimised for handling virtual methods, across both time and space. Extensibility and flexibility are also significant considerations. The model will support DLLs and communication between applications. Continuing Microsoft's emphasis on inter-language issues, the run-time object manager will also use a common, inter-language format for object access.

The Future

Because it is a relatively new language, C++ lacks the body of test code that exists for C, BASIC or Pascal. It is Microsoft's policy that

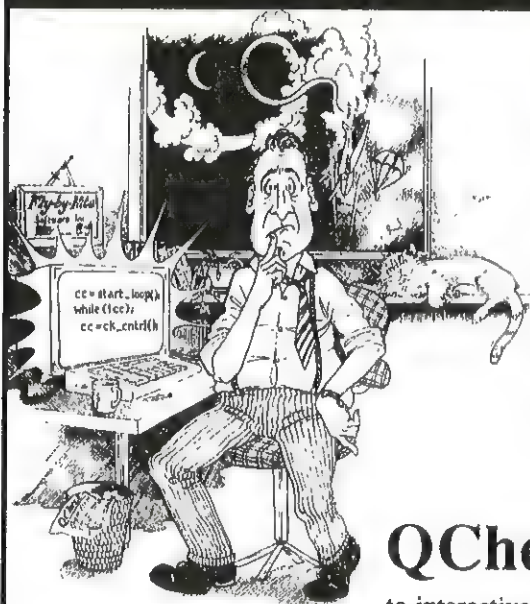
vendors of compilers, libraries, and add-on tools must develop methodical, scientific test sites to ensure that programmers have reliable tools. Microsoft hasn't rushed into the C++ market, because the company wants to be sure that its C++ product is the most reliable, as well as the most innovative.

The launch of Microsoft Windows 3.0, and the growing corporate interest in OS/2 Presentation Manager, has thrown down the development gauntlet to programmers. End-users are now demanding graphical applications that are easier to work with and increase productivity. Tomorrow's graphical applications will be developed using object-oriented systems. Before this can happen, C++ needs the infrastructure, inter-language calling, programming support, and user-interface tools that will enable programmers to make use of present C code and break new ground using C++ code. Microsoft's C++ product will meet all these needs.

EXE

Andrew King is the Languages Product Manager with Microsoft UK in Reading. We all await Microsoft's next move with interest.

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Software Interrupts Disabled

Many of the disabled have their own PCs. Much of the software they buy doesn't work. Dan O'Brien finds out why, and gives some guide lines for developers.

Almost all disabled people who can afford it buy a computer: usually a PC-compatible. Connected to suitable I/O devices, even the most severely handicapped benefit from using one. Some of the gains come from using the machine as a tool to overcome their disability - to operate appliances remotely, or to allow deaf users to use the telephone via a modem. But many disabled buy a computer simply to use conventional packages: spreadsheets, word-processors or data bases.

It's not always easy, though. Commercial PC software can be very intolerant of strange systems (as anyone with unorthodoxies in their CONFIG.SYS will tell you). Naturally, PCs used by the disabled - particularly the visually disabled - are often adapted in some way, with extra hardware and software replacing the more usual I/O peripherals.

The Add-ons

The range of add-ons is vast. The simplest are low-tech adaptations of familiar hardware: many partially sighted users work with standard PCs with a 36" screen monitor and a large-print keyboard. Others are more complex - like the Optacon II (the Optical-to-Tactile Converter), which is an awe-inspiring combination of a hand-held camera and 100 vibrating rods. The rods are arranged in an array of 5 by 20, and produce a tactile image of the text being scanned. The system can also be connected to a PC, where the mouse is used point to the area of the screen that should be reproduced. A snip at £3195. In fact, there is a great deal of very impressive technology at the £3000 to £10,000 price level: OCR readers, braille displays, home appliance drivers, advanced screen magnifiers. Oddly enough, however, few users can afford one of these machines on top of the cost of their PCs.

Cheaper I/O systems are more ingenious than dazzling. Many readers will remember the coverage given to the Microwriter by computer magazines in the early 80's. The Microwriter was a very clever arrangement of seven keys which replaced an entire keyboard. Once accustomed to it, users were reckoned to be able to type faster on the Microwriter than was physically possible on normal keyboards. It never caught on, but has reappeared recently as the Agenda, and is one of many keyboard adaptations more suited to the disabled than the standard layout. For disabled users unable to use their limbs, suck-blow systems such as the Possum range can also operate as standard keyboards.

On the output side, the two most popular replacements for the screen are speech synthesisers and braille displays. Not everyone can read braille, and, because of its specialist nature, the hardware tends to be expensive, so the swing seems to be towards

speech systems. Some are self-contained and smart, like the Votrax boxes. It's more usual now, however, for the hardware to be relatively dim-witted, with most of the hard work being done by TSRs. This move to software is noticeable in all areas of disabled development. A few years ago, the only way braille typists could enter data, for example, was by attaching an expensive braille keyboard to the serial port. Now, a simple TSR converts a normal AT keyboard into one usable by a blind typist. This lowers prices, although it does have the disadvantage of increasing incompatibility.

The Problems

Usually developers try to avoid these sort of problems by allowing their software to be customised to work on a range of common configurations. Unfortunately, few companies recognise disabled hardware as common and, just as architects will happily dump public amenities at the top of trea-

- Follow the TeSseRact/Borland TSR conventions.
- Allow redirection.
- Allow a text-mode GUI.
- Allow the defaults to be redefined, and automatically load-up on starting the application.
- Don't expect users to be able to swap cables around, change hardware and so on.
- Don't depend on sound cues.
- Have a consistent interface.
- Try to avoid flashing characters, and allow colour choices to be re-defined.

Figure 1 - Guidelines in Writing for the Disabled

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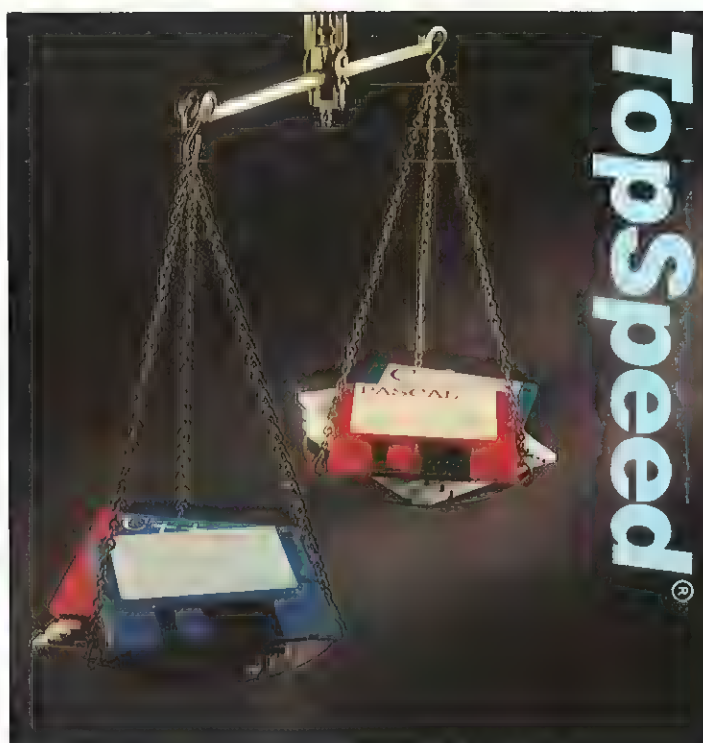
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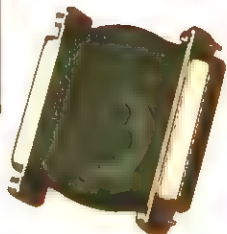


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cherous steps and then hide behind tiny revolving doors, so many developers forget the needs of the disabled market.

To be fair, it's not entirely their fault. There are an awful lot of peripherals, and most look intimidatingly alien to programmers accustomed to a screen, keyboard and mouse system. A blow-suck tube seems a long way from a familiar QWERTY keyboard. Output devices are even more daunting. It's hard to imagine how to code flexibly enough for a 40 character braille display as well as a screen full of windows. And how could one possibly write a GUI that the blind could use?

In fact, adapting current applications to the needs of the disabled is not difficult. Generally, disabled add-ons are designed to be as unobtrusive as possible. Some devices, for example, are plug-in cards, operating straight through the bus and are, therefore, essentially invisible to applications running on the 80x86. This is how the more expens-

ive screen enlargers work, taking their information direct from screen RAM. More often, peripherals will hide their idiosyncrasies behind TSR utilities that trap screen and keyboard operations. This allows even quite exotic peripherals to be driven by standard screen/keyboard applications.

These drivers can be quite sophisticated. Screen reader TSRs, for example, are used by the blind or partially sighted to allow them to use a PC screen - the TSR selects important information from the screen, and relays it to a braille or speech system (see 'Discerning Readers'). Other aids for the disabled are just TSRs, with no extra hardware required. The cheaper screen enlargers work this way, scaling one half of the screen rather like the 'zoom' feature on drawing packages. That is, they do if the TSR and the application can work together.

Which brings us back to square one. Even with the most intelligent TSRs and the most benign hardware, some applications will

refuse to work. It is tempting here to give up: on any given system, after all, there are always one or two programs that won't boot. Tough luck if it's Windows 3.

The Solutions

This attitude (apart from showing a *shocking* cynicism about this wonderful industry of ours) also misses one of more interesting aspects of coding around these problems. Generally, compatibility guides revolve around quite small (and usually irritatingly picky) coding constraints: always use your API, never directly address hardware, never even think of being incompatible with MS-DOS V1.0. But because of the nature of disability, and the resilience of TSRs fully accustomed to such dirty tricks, guides to disabled systems compatibility concentrate more upon design flaws in the user interface. In fact, most of the insurmountable difficulties of the disabled are simply 'abled' irritations with interface design magnified.

To give an example: one of the guidelines suggested by disabled systems designers is to allow interface defaults set by the user to be automatically loaded up at the start of every session. A reasonable request - everyone understands the irritation of having to reload the colours and key-codes with which they feel comfortable. But for a disabled user, it could well be impossible to use the program at all until a suitable set-up had been entered. And if that inability includes being unable to enter the 'load new setup' command, the program is as good as useless.

Fortunately, the areas where software falls down are easily correctable: they're also largely due to sloppy program design. Some of them are deliberate awkwardnesses: copy protection (particularly dongling) can play merry heck with disabled interfaces. Most, however, are features that programs are better off without, and were only left in because they are just seen as a minor irritation to most users. Others are features that most users, I suspect, would appreciate in their software anyway. Figure 1 gives a brief summary.

The Guidelines

Not all the guidelines are high-level design considerations: the first two come straight from the grubby underworld of MS-DOS command programming. Standard I/O redirection (as used in MS-DOS's CTTY command) is one of those MS-DOS dark corners that seems to have been included so that Microsoft could say 'oh yes, we've got that.' Certainly, its use is not as widespread on PCs as it is in UNIX. A shame, as it does

Discerning Readers

One of the smartest pieces of software used by the disabled is a screen reader. There are a number on the market, including an official IBM release, but they all work on roughly the same principle. Users press a hot-key that freezes the current application. The screen reader TSR takes over and dumps any text on the screen out to the serial port, where it will be interpreted and spoken by a voice-synthesiser unit, or else displayed on a braille panel. Naturally, this can take a large amount of time for a full screen dump, so most screen readers have evolved some way of selecting what, on the screen, is worth saying (or brailleing). Simple screen readers will keep an eye on the PC's hardware cursor. If it moves, they will send out whatever was in its old location. This is a fine approach for command-line programs, but it will miss any direct poking into screen memory. In fact, cursor readers are lost on any program that refreshes more than one screen item at a time. This makes it impractical for windowed software.

More intelligent readers look for areas of change on the whole screen. Obviously, this can slow things down if done indiscriminately; not every change on the screen reveals new information. There is no point in speaking the text changes caused by a window move, for example. The smartest systems are even more discriminating, looking for updates of particular text, in a particular colour, in a particular place. This covers most of the problems, but requires individual customisation for each application. These definitions can be quite awkward to implement (the IBM ScreenReader files read like high-level source code) and can be thrown entirely by cosmetic changes to the application. With some savvy, confused readers can guess the importance of unknown appearances, but even the best can be thrown.

Icons and other graphics are, of course, ignored. More frustrating is the difficulty in capturing even plain text on a graphics screen. Text in a graphics mode is just another slice of bit-map to a TSR, and given the number of fonts, sizes and styles modern GUIs use, any graphic screenreader would require some pretty hefty OCR algorithms in order to reconstruct the original ASCII. This is one of the reasons why a text mode option is so important to include in a windowing application.

All this may sound somewhat pessimistic - it's not. Most applications can be handled by the current batch of readers with a little effort. Even GUIs are surmountable. With the growing acceptance of API-based WIMP systems, companies are working on readers that trap 'write text to screen' function calls, allowing the original text to be pulled off the argument list. Simple. Now, if only programmers *always* used library functions...

allow disabled users the ability to run the MS-DOS command line from the serial port I/O. It's a quick and easy way of rendering text applications usable, and any application that uses standard I/O handles will support it. There are some famous exceptions, however: Microsoft BASIC writes straight to the video screen. The chief argument for skipping the MS-DOS I/O system in this way is speed; fair enough, but a self-respecting program should at least include an option to turn slow screen writes back on. Note that this guideline only really applies to text-only programs run off the command line: there is no sense in trying to half-comply within a graphics application. More sensible would be to allow some internal redirection: an option to take commands from the serial port, perhaps.

Complying to the almost-industry-standard Tesseract/Borland TSR conventions is pretty obvious. Again, remember that a system that will not allow TSRs is not just irritating to disabled users, it is entirely useless. Terminal programs were cited as particularly bad offenders here. Some, for example, feel that if they supply Sidekick-like utilities within the program themselves, they can stomp all over the interrupt table. Not so.

Text mode GUI operation is very important. As the box on screen readers explain, graphics mode environments are difficult to translate for any other device, even if the information presented is largely text. A text-based program should be able to run an MDA mode, if pushed: Microsoft Word is a good example of a program which, while normally running in on a graphics screen, can run to text only. And text mode is *always* faster.

We have already mentioned loadable defaults; the swapping disks guideline should be obvious. 'Don't depend on sound cues' may need some explaining. This sugges-

tion cropped up after one user mentioned a program that signalled a dangerous state by beeping. No other signal was given. Everything on screen continued as normal, and the program responded as though nothing had happened, except for the constant beep. Annoying and confusing for users who could hear the warning; useless to a user with impaired hearing. A trivial

Most disabled developers have little time to work on new and better products

guideline, perhaps, but more widespread than one might think. The spell-checker I'm using now (which beeps when I type an incorrect word) would be just as unusable. Small visual prompts are not difficult to include, and could easily be turned off by those who found it distracting.

Consistency is interesting. One smart trick screen readers use to decide on the significance of new text is to guess where the next important message will appear. So a screen reader will always keep an eye on either side of a drop-down menu, because this is where sub-menus often pop up. Other areas of the screen are always seen as important: error lines, for example. A side effect of this is that it is very hard for screen readers to cope with inconsistent interfaces that throw up their windows in a haphazard way. Wordstar, for example, is terribly capricious in its positioning of in-

formation. The rule is: either use consistent rules, or (like Lotus 1-2-3) have clearly demarcated areas for differing types of message. Don't give each message its own special spot and colour.

Allowing colour choices to be redefined is another one on the universal wish list. Or at least, one would presume so: the issue of whether users should choose their display colours is a bit of a controversial one in the world of interface design. Apparently, most people choose horribly cutesy pastels and productivity (for some reason) then nose-dives. The situation is very confused: one book eventually suggests that programs based on neural networks should decide on the correct combination, which sounds like passing the buck to me. For disabled users at least, user choice is preferable. The range of visual disabilities means that some seemingly perfect colour combinations are unsuitable. Playing around with the colour options also allows screen readers more flexibility. The warning against flashing text is there as several visual disorders make flashing symbols difficult to read. And most people find them annoying anyway.

More Problems...

Following these guidelines helps, but it's clearly no guarantee of invulnerability and it certainly does not cover every difficulty. To be absolutely sure, of course, applications need to be tried out and tested. Unfortunately, the big application firms aren't exactly forthcoming in allowing charities to test their software. Companies are generally very keen initially, and show sincere inclinations to help out in the interests of universal brotherhood and good advertising copy. Unfortunately, the good intentions usually fade away in a flurry of departmental shuffles. The bigger the company, the worse the record. One well-known spreadsheet manufacturer practically vanishes when asked. Ironically enough, IBM themselves are disarmingly nice, with a free advice line based in Warwick (0800 269 545), a good record in supplying disabled systems designers with the latest software, and a number of active disabled research centres both here and in the US. (The disabled in America are rather better off in a number of ways, thanks to a stipulation in all federal contracts that government systems should be accessible to the disabled. Watch those big names reappear.)

Given all this intransigence, most disabled developers are forced to buy the software as it appears, and are kept busy overhauling their software with each new release, eliminating the new problems that new versions (almost inevitably) create. This means they



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have little time to work on new and better products. It's also quite costly, and the cost is passed onto the user. Most disabled systems are expensive - more expensive in many cases than if they were sold as standard peripherals - and not all the cost comes from the scale of operations.

More solutions?

What could be done? Ideally, applications developers want a test suite: some sort of compliance test for new software. At the moment, this seems impractical. As mentioned, there are many peripherals available, not all of which are manufactured by the same company. Also, the requirements of disabled people vary wildly, and, as we've seen, not every problem is a simple software or hardware incompatibility; design considerations are also important. Perhaps more feasible is to allow the companies and charities that use and support disabled systems access to new software. The box above gives some useful addresses. This isn't a 'please send your used software' appeal, incidentally: but anyone interested in having their software tested, or screen reader configura-

tion files made up for their application should contact us.

Most of the difficulties of the disabled are simply 'abled' irritations with interface design magnified

And, as a footnote (just in case you need someone else convinced), it's worth pointing out from a business point of view that, given the wide networks of advisory centres that most of the charities run, a product passed as usable by the

disabled design companies is much more likely to be recommended to all the disabled people who are considering buying a PC. Which is quite a few extra users.

EXE

Dan O'Brien is the new Staff Writer for .EXE. Magazine. He cheated in his interview, and copied the REVERSE program from the original on the editor's hard disk.

For those interested: There's not, as yet, one organisation which can deal with any disabled software enquiry. Worse, the only people who are technically proficient enough to assist software developers are already rushed off their feet running support companies for the disabled themselves. As it is the visually disabled who generally suffer most from incompatible software, it is the RNIB who are most involved in testing and advising on software. They can be contacted at their Employment Development and Technology Unit, which is at 224 Great Portland Street, London W1N 6AA. Tel: 071 388 1266. The .EXE offices have the addresses of all the major UK developers in this field: we'll send this to anyone who posts us an SAE. Mark the envelope 'Disabled'.

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Here's the Kit

The Windows 3 environment has done rather well during its few months of public scrutiny. But what of the Developer's Toolkit? Jeffrey Goldberg reports.

Hyped to the extreme, talked about for seemingly an aeon, Windows 3 struggled into the world in April this year. Naturally, us poor programmers had to wait until August before we were officially allowed to program the said environment. ('Officially' because anybody and their cat managed to get hold of a beta copy of the Software Development Kit [SDK], which you need to get going. Some trusting companies, such as Samna, even managed to sell shrink-wrapped software made from these beta tools.) The question is, was it worth the wait?

Out of the box

One thing is immediately clear upon unpacking the software. The system requirements for the toolkit have jumped to ridiculous proportions. Microsoft states that in addition to the normal Windows configuration you need:

- 286/386/486 system with 384 KB of extended memory,
- secondary monochrome monitor and adapter card or a twin 8514/VGA combination (the former being cheaper and more useful for testing),
- Microsoft Mouse (or compatible),

- Microsoft C 5.1 or 6.0 or Microsoft MASM (actually, you just need a Windows compatible compiler such as TopSpeed Modula-2 or Zortech C++),
- A hard disk with 5.5 MB free for the SDK.

In my experience of the toolkit, you actually should have, in addition:

- Microsoft Word (either for Windows, MS-DOS or Macintosh) or a word processor capable of producing Rich Text Format (RTF) for making help text,
- Microsoft MASM or Borland's TASM V2.0 for making DLLs and compiling the examples,
- a 386 or 486 computer, for speed and the ability to use all three Windows memory modes plus EMS/non-EMS,
- a fast hard disk with at least 15 MB free space (my setup had about 25 MB taken by the Windows development system, plus a 10 MB Windows swap file),
- at least 2 MB of RAM, (going on 4 MB for comfort),
- a serial terminal if you want to run the advanced protected mode debugger.

The Windows 3 SDK consists of a set of utilities, some C and MASM header files and libraries, plus the documentation. The tools

fall into three categories: resource editors (such as a dialog box editor), debuggers and optimisation tools, and a Windows help compiler. The INSTALL program copies the stuff over, makes one or more replacement C run-time libraries, sets up a debugging version of Windows and adds an SDK Tools group to the Program Manager Window.

The files on the SDK disks (as with Windows 3 itself) are compressed, so you are almost forced to use the INSTALL program. Luckily, it is similar to the text part of the Windows 3 SETUP program, and just as slick. You are quickly led through questions such as: *In which directories do you want to place the SDK?*, *Which memory models do you wish to use?* and *Do you want the sample source code?* At the end of installation, you are deposited at the DOS prompt. Unfortunately, if you start Windows at this point, you can't double click on any of the SDK Tools in the Program Manager as the SDK tools aren't yet in the path...

Resource Editors

A Windows Program consists of a (usually) C code part, compiled and linked in the normal fashion, plus some 'resources', compiled by the special resource compiler, and attached to the end of the .EXE file. A resource can be any string, menu, dialog box, font, icon, mouse cursor or bitmap associated with the file. The SDK contains an MS-DOS based resource compiler and three Windows-based tools: SDKPAINT for icons, cursor and bitmaps, DIALOG for dialog boxes and FONTEDIT for fonts. All of the Windows tools require a mouse - if you don't have one they politely request you visit your local computer store and exit.

Input to the resource compiler takes the form of a resource script (.RC file) - an ASCII file. This script file controls inclusion and use of other resources, while also defining the strings, menus and accelerators. Resource scripts have a simple format (unless generated automatically by DIALOG). For example, a quiche making program might

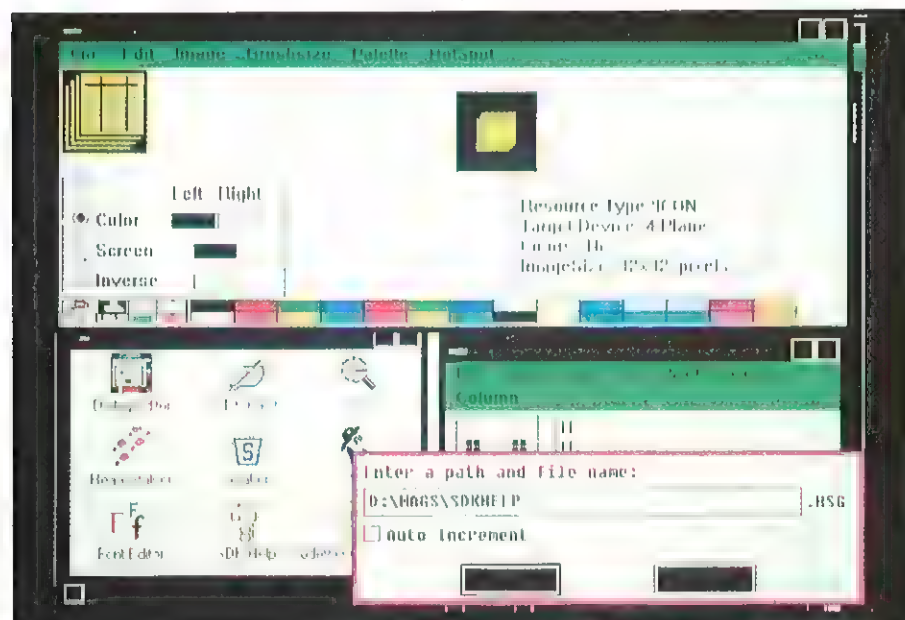


Figure 1 - FONTEDIT and SDKPAINT in action

C is a language with a reputation of being tough to get in to. Whilst its advantages of speed, power and portability are well known, many programmers do not have the time to learn it or to build the extensive library of functions necessary for the development of even simple applications. Debugging programs is also a long and tedious task as C requires the programmer to control every aspect of the machine as well as the application. Precious design time is swallowed up by programming and debugging.

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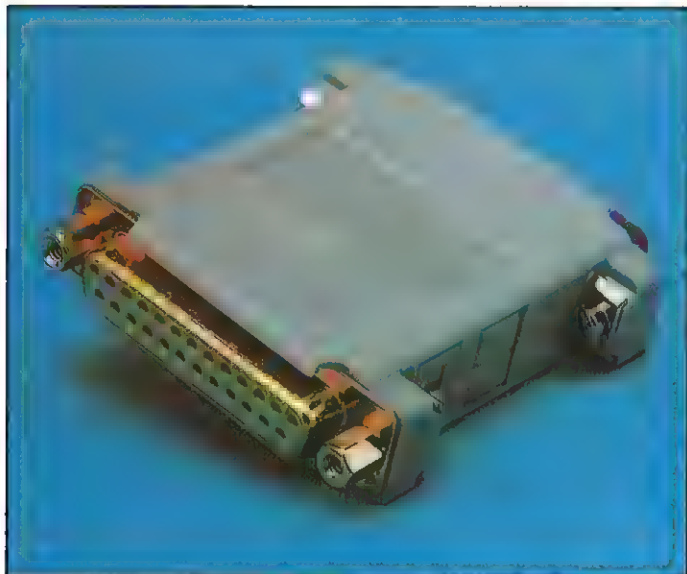
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have a resource file like that in Figure 2. The `#include` directive is just the same as C's. The file `QUICHE.H`, with `#defined` constants `ID_SPINACH`, `ID_ONION` and `ID_MUSHROOM`, is shared by the resource script and the C program - the constants are the numbers the programmer uses to determine the menu item. The `QUICHECURSOR` defines a cursor made by `SDKPAINT` in the file `QUICHE.CUR`. The `QUICHEICON` likewise defines an icon in the file `QUICHE.ICO`. The menu has a heading 'Flavours', and three items in the pull down section. The '&' character in the text strings represents the ALT or F10 key used to activate the menu. For example, the key sequence 'F10 F M' will deliver a Mushroom flavoured quiche to your table.

Because the resource compiler must be involved in the creation of every single Windows program, it is used to perform some special marking functions. The most important of these is the marking of an application as Windows 3 compatible. This prevents that annoying box appearing each time you run an unmarked (= Windows 2) application under Windows 3.

`SDKPAINT` (see Figure 1. The picture is not quite right, owing to the late discovery of the incompatibility of our screen capture program with Windows 3 - Ed) uses the analogy of a paint program to make the icons, bitmaps and cursors used by a Windows program. You click the left mouse button in the bitmap to set a pixel and the right button to clear it. The Color radio button in the dialog box underneath the bitmap selects the colour you get when you press a button. The Screen radio button sets the colour that defines the screen background colour while Inverse sets inverse of the screen colour. The drawing tools provided allow you to fill closed areas and create the following shapes: lines, filled/hollow circles and filled/hollow rectangles. `SDKPAINT` is fun to use, and I frittered away hours twiddling with icons and cursors. `SDKPAINT` did crash on me a few times, once in a reproducible way, but several times not, so watch it. Another feature: sometimes you

click on a colour and `SDKPAINT`, apparently sneering at your poor taste, will substitute an entirely different one.

`FONTEDIT` (Figure 2) is very similar to `SDKPAINT`, except that it applies to fonts. You have a different selection of drawing tools, such as rotating a block of pixels. There are also special controls that relate to fonts such as widths, weights, font family, character set and pitch. Most Windows programmers use `FONTEDIT` once in a green Saturn.

Because of the splendid on-line help system, the Reference manuals barely got touched

On the other hand, programmers have to use `DIALOG` a lot to design those dialog boxes over which we all expend such loving care. In theory, `DIALOG` is simple: you draw the dialog box, choose a control from a movable toolbox or menu, and then select its ID and attributes by double clicking on the control. In my limited use, the tool caused me to swear more than any other tool.

Let's deal with `DIALOG`'s user interface problems first. Ask for a new file and dialog, you are presented with a dialog box outline too small to be of any use. So you make it bigger, so that you can put something in it. But at this stage you have no idea how big the outline needs to be - you will have to resize again when finished. Why can't the border auto-size itself as controls are added? You then add a control by menu item or toolbox, a crosshair appears and

you click at the place you want it. Trouble is, the control is always the wrong size, so you must resize it - which involves selecting the control and dragging it. If you add a control with text, the control doesn't resize when your text is bigger than the currently set size. This means yet another resize. If all this wasn't enough, Cut and Paste work at the dialog level, so you can't easily copy a selection of controls from one dialog box to another.

`DIALOG` also has a number of strange anomalies. You cannot reset a dialog's global settings in some circumstances. Dialogs mysteriously overlap the menu bar. There is a dialog box in a non-systems font. The worst problem is that `DIALOG` won't accept a header (.H) file that contains anything other than `#defines`. Comments, or any other imperfections, are *verboten*. I also experienced various system crashes when `DIALOG` was running with another program such as Microsoft Word. This could be due to a number of reasons, but other people who have used `DIALOG` have also found it to crash from time to time.

Debugging Tools

The SDK comes with eight (!) debugging tools, perhaps saying something about the difficulty of programming Windows in C and assembly language. The debugging tool with the most functionality (and most system requirements) is CodeView for Windows. This is a Windows program that requires two monitors; the CGA/EGA/VGA/8514 one containing the normal Windows screen, the monochrome or VGA containing the familiar CodeView screen. This works very well, since you can always see the line of code and the result at the same time. The rest of CodeView for Windows is similar to CodeView V3.0 for MS-DOS. The main enhancements are the ability to display Window's local and global heap, being able to track Windows messages and the use of protected mode.

This last feature (termed 'standard and enhanced modes' in the Windows context) means that there shouldn't be any memory problems even for big programs. However, the debugging symbol table is loaded into memory, so you'll need oodles of expanded memory for any decent sized program. Microsoft recommend 1 MB or more of expanded memory for programs with many symbols. CodeView for Windows, therefore, requires more hardware than the rest of the SDK. If you don't want to use it, the system requirements fall dramatically.

The use of protected mode by CodeView for Windows means that it doesn't work in

```
#include      "QUICHE.H"
QuicheCursor CURSOR  QUICHE.CUR
QuicheIcon   ICON    QUICHE.ICO
QuicheMenu   MENU
BEGIN
    POPUP "&Flavours"
    BEGIN
        MENUITEM "&Spinach", ID_SPINACH
        MENUITEM "&Onion", ID_ONION
        MENUITEM "&Mushroom", ID_MUSHROOM
    END
END
```

Figure 2 - Resource File for Quiche-Making Program

real mode. Instead, you have to use Symdeb - the symbolic version of DEBUG. Older readers might remember that it was shipped with Microsoft languages before CodeView came into being. Unlike CodeView for Windows, you can use a serial terminal for the Symdeb screen (although it can drive a second monitor instead). Symdeb is a rather rudimentary tool for the 1990s. You should not be forced to use it, even in real mode.

CodeView for Windows and Symdeb don't allow the tracking of low-level features of protected mode such as Global, Local and Interrupt Descriptor Tables (GDT, LDT and IDTs), paged memory and 8086 Virtual Machines (VMs). Microsoft has thoughtfully provided the 80386 debugger - WDEB386 - to allow access to these things. It's simple, DEBUGish interface hides a utility dripping with power for assembler hackers. I had great fun with it, but I suspect most users won't need to use it in anger. Incidentally, the 80386 debugger is a misnomer - it runs happily on a 286 or 486 processor, in spite of the documentation. Unfortunately, it only works with a serial terminal and not a second monitor. You, therefore, need two monitors and a serial terminal on your desk if you are going to use all three debugging tools. Microsoft programmers must have big offices with long desks.

Microsoft, perhaps bitten by the reputation of Windows programs for being slow, has provided two profiling tools. The first, PROFILER, lets you sample the amount of time Windows spends executing pieces of code. The second, SWAP, lets you analyse the number of procedure calls across segment boundaries.

PROFILER uses the CMOS clock chip to time the application between two entry points, ProfStart() and ProfStop(), that you place in your code. The samples are recorded in a buffer which gets written to disk when Windows terminates. You then run an MS-DOS program, Showhits, which uses the

The help system writer has to cope with the weird but powerful help format and a very slow compiler

symbol files to give a simple report on the percentage spent in the Windows Kernel and the procedures between ProfStart() and ProfStop(). For some reason, PROFILER doesn't run in Windows Standard (286) mode.

Swap uses a special version of the real mode Windows Kernel that logs Windows swapping behaviour to a file. You enable this logging process by placing a SwapRecording() call in your application. A DOS program, Swap, interprets the log and displays the result on the screen.

Microsoft provides two tools for finding problems with your use of Windows memory management: Shaker and HeapWalker. Shaker randomly allocates and frees chunks of global memory for you to see the effect of memory movement on your application. Heapwalker allows you to view the global heap, allowing you to allocate and free memory interactively. The last tool, Spy, allows you to monitor system messages sent to a specified application window.

Help!

New to Windows 3 is a generic help system. All applications can use it to provide on-line help text. The SDK provides a 'help compiler', plus some documentation that describes how to make a help system and gives the extra code that is needed.

The application programmer comes the best out of this deal because while not trivial, the extra code for a help system is hardly a major effort. The person who has the brain strain, however, is the help system writer. He has to cope with the weird-but-powerful Microsoft help system-format and a *very* slow help compiler. So slow that, when I first compiled the help example, I thought it had crashed - 70 seconds of 486 processing for a 35 KB file is serious.

The help writer has a lot of flexibility at his disposal. He can use bitmaps, multiple fonts, variable text sizes and different colours to lighten up the text, although for some reason you can't use the Symbol font. The help can contain cross references which jump to another topic, cause a box containing a definition to pop up and/or refer to an index independent of the topic. Once you get the hang of it, it's really rather good.

The SDK comes with about four inches of documentation: four Microsoft perfect bound manuals, an IBM SAA CUA Design Guide and an installation guide. The Microsoft manuals are all typeset with a distinct splash of Ventura, and are well-written but with heavy seasoning of spelling, formatting and factual errors. All the Microsoft manuals use the annoying Chapter Number-Page Number scheme, for example 6-3, for page numbering.

The thin Installation and Update Guide provides the starting point for the manual set. The manual goes through installation, gives hints and tips for optimising your development environment and provides an overview of Windows 3 for new and Windows 2 SDK users. It's a good introduction to the SDK.

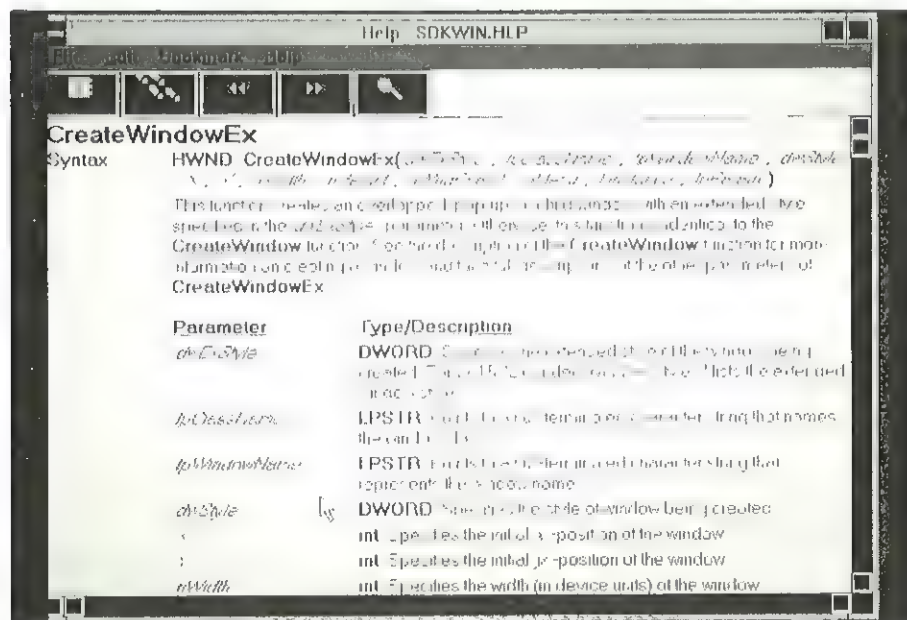


Figure 3 - Windows V3.0 API help

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CIRCLE NO. 333

The Guide to Programming is Microsoft's latest attempt at a tutorial for Windows programming. It gets stuck between two hurdles, being too advanced for the beginning user and lacking some meat for the advanced user, though the advanced section is the best part. It is ideal as an adjunct rather than a substitute for Charles Petzold's *Programming Windows* (ISBN 0-914845-91-8, Microsoft Press £22.95, but wait for the Windows 3 version) as it provides information on the new whizzo-bang features that the current Petzold book doesn't.

The remaining manuals are Parts 1 and 2 of the Reference Guide. Part 1 contains an introduction to each group of functions, and an alphabetical list with description of each function and message. Part 2 contains the bits of the reference that don't fit into Part 1, such as assembly language macros, file formats, data types and structures, and a description of the 32-bit memory management DLL.

Part 1 of the reference has the best layout of a Microsoft manual I've seen. It has thumb tabs for easy reference, clear headings, proper typesetting and well spaced text. All that is missing are examples to go with the descriptions and removal of a large dose of double negatives in the descriptions. Part 2 of the reference isn't nearly as good - the many smaller reference pieces making it more difficult to find information.

When programming Windows with the SDK, I found that the Reference manuals barely got touched, even for the new Windows 3 functions. Indeed, if it hadn't been for the review, I doubt they would have made it out of the wrappers. This is because of the splendid on-line help system. You have two choices of help system: one for the Windows 3 help system (1.9 MB), the other for Quick Help, QuickC and C V6.0's Programmer's WorkBench (750 KB). I only used the Windows version, which allowed me to have one window with an editor and

another with the help function. The help uses colours effectively, with green indicating a cross-reference and red indicating a Windows 3.0 function. I found the ability to add an annotation to a help page invaluable, as was the facility to place a 'bookmark' on frequently used pages invaluable. There are faults, however, such as the inability to paste a part of the help text (for example, the function prototype), the inability to pick up the context from an editor and the lack of random text searching in the index.

The final manual is from IBM - the grandly titled *IBM Common User Access Advanced Interface Design Guide*. A better title is *How IBM told Microsoft to do the User Interface for OS/2*. It contains a mine of useless information, such as the Finnish for check box (tarkistusruutu), and a few coals of useful stuff.

In addition to the paper documentation, there are five additional files on the disk, two of which are READMEs: one in ASCII (8 KB), the other in Write format (57 KB). The other three contain a selection of wise sayings on how to use Windows with the C V6.0's Programmer's WorkBench, and how to program Windows with networks. The README also informs you that you can obtain an additional document, 'The Windows Developer's Notes', for a nominal charge. I have not managed to obtain a copy, but it is advertised to document the following: Windows Setup Sources, Preparing Windows Applications for International Use, Windows Executable File Header Format, Windows Font File Format, Windows Support for DPPI and Windows Write and Calendar File Formats. Why couldn't Microsoft just include this information in the SDK in the first place?

Conclusion

Microsoft has made a professional job of the SDK - it is a large improvement on the earlier version, and is good value for money. The tools supplied are adequate, but do leave a gap for enterprising companies to do better. The documentation and help system make it easier to program Windows than ever before. Nevertheless, even with this improved SDK, Windows remains intimidating to the beginner.

EXE

From V2.0 to V3.0

The Windows 3 SDK is a light year ahead of the V2.0 SDK, and justifies the £100 upgrade fee. You get the same contents as the retail version, in a sturdy, dour cardboard box. What is new:

- Better install program that allows you to install only the C libraries and a debugging version of Windows on the same disk.
- Improved Windows C run-time libraries. These include separate libraries for DLLs and applications, and a model-independent import library (instead of the model-dependent libraries previously shipped).
- The language tools such as LINK4, EXEHDR and IMPLIB are no longer included with the SDK. They are available on a separate disk from Microsoft.
- Several new tools: SDKPAINT a colour icon/cursor/bitmap editor that replaces ICONEDIT, a CPU profiler, a segment swapping reporter and a help compiler.
- 'Enhancements' have been made to the existing tools.
- The API has been expanded including support for device independent colour bitmaps, colour palette management, Multiple Document Interface applications, and several new types of controls and menus.
- New sample applications are much better, but the kit lacks the CardBox application of V2.0.
- No Pascal libraries are supplied, perhaps in embarrassment.

The documentation has both improved and got worse. The new *Guide to Programming*, replacing the *Learning Guide*, has a reasonable Advanced Section, covering most of the major new stuff. All manuals are better laid out.

The bad news: the Reference manuals clearly indicate a V3.0 function but ignore V3.0 additions. For example, `CreateWindow()`'s a new counterpart `CreateWindowEx()` which has a version 3 sticker, but the new control styles for `CreateWindow`, such as `LBS_MULTIPLESEL`, don't have any indication that it's a V3.0-only style. Also, nowhere can you obtain a list of the new Windows V3.0 functions. The other piece of bad news, perhaps, is that the manuals are now perfect bound instead of ring bound.

Jeffrey Goldberg has eaten Raspberries while playing Cricket in a field full of Penguins for Borland. He is now stroking Fifi while feasting on Pizza at Psion.

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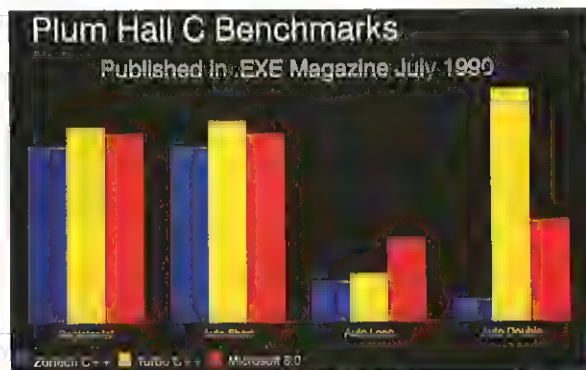
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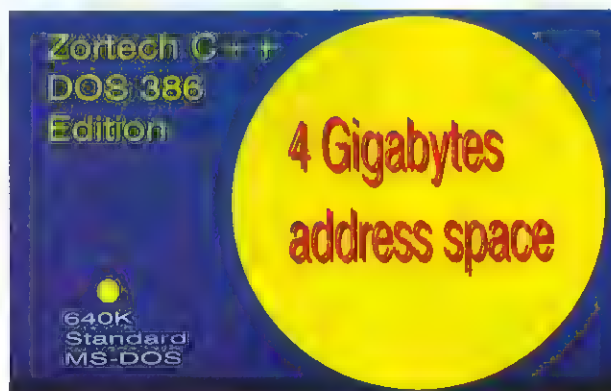
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All Right Now?

dBASE IV V1.0 earned itself and Ashton-Tate a very unenviable reputation. Does V1.1 put matters right? Bob Rimmington reports.

dBASE IV was first released in the Autumn of 1988, and was fully reviewed in .EXE Magazine in February 1989. Although there were many new and attractive features, a variety of serious flaws were identified. Experience in actual applications served to confirm these and, as a consequence, many developers and other users chose to delay a general switch from dBASE III+ to IV until a debugged version was available.

In the intervening two years, Ashton-Tate has announced a succession of target dates for upgrades - which have passed without any software appearing. These details are now history, as V1.1 has now arrived. This article does not offer a full description of the product. V1.1 differs only in detail from its predecessor; those wishing to know more are referred back to the original .EXE review. Instead I will look at the changes, the performance and, above all, the reliability of the revised version.

First sight

This review describes the Standard Edition of dBASE IV V1.1. File compression has helped keep the number of 360 KB distribution disks to 10. The accompanying documentation is in Ashton-Tate's usual style, clear and well presented. Less commendable is the number and varying formats of the books themselves. A substantial A5 ring binder for the main reference manual, several spiral bound supplementary manuals and another half dozen perfect bound

books of between 60 and 380 pages each. They also come in two heights. It may be logical, for example, to split networks, application generator and advanced topics into separate volumes. However, it is less easy to keep them all tidy on the shelf and to search through several in turn for an

Tests that had previously revealed memory problems now ran normally

answer. There is no slip case in the new release, presumably A-T are trying to keep costs down. Further evidence of this comes from closer study of the books. Six are the original versions and must be corrected by the user from a 28 page list of alterations. This is all a bit cheese-paring, especially for the quick reference guide where there is just no room to write in the additions.

Installation is now quite painless. Three options are offered, *Quick* for a simple 'do everything', *Full* with some user options (and mandatory for networks) and *Menu-driven*. If you want to load up the sample

and tutorial files, you'll need to set aside about 5 MB, exclude them and you will save about 1 MB. Interestingly enough, the system files themselves actually occupy only 3.5 MB - the extra space is presumably required for the temporary files. Configuration is a separate operation, done by using a program called DBSETUP from the MS-DOS prompt. It allows selection of printer drivers, colours and a variety of default settings. One of these, unique to the British edition, answers a strong criticism of our original review. Indexing sequence can now be set to ASCII as an alternative to 'dictionary' order (AaBb ... 123). No problems now with the setup and, once you are configured, it is possible to transfer about 500 KB of files to a floppy disk (for any subsequent re-configuration) if you want to reclaim the hard disk space.

Is that a bug?

The three crucial questions about V1.1 are: *Is it now reliable?*, *Will it fit available memory?* and *How does it perform?* Reliability no longer seems a problem. If any bugs remain, I couldn't find them. Absolute perfection in today's complex software packages is unrealistic, but all normal operations should work. V1.1 did not falter at any of the points that had previously been a problem or indeed at any other tests. Even so, there are still remnants of that 'not quite finished' look. A message box may appear with one side a different colour, and when it clears, the bottom of the frame may remain. Nothing significant, but a bit disconcerting.

Memory requirements have been reduced to a stated 450 KB available out of an installed 640 KB. In fact, the software itself, as initially loaded and at the dot prompt, takes just 290 KB. This is a big improvement and tests that had previously revealed memory problems now ran normally. Sev-

Total available RAM (as reported by CHKDSK)
Subtract 357 KB
Multiply answer by DBHEAP/100
Add 38 KB
Answer = RAM available for data & programs

Figure 1 - The Formula for DBHEAP

PC LAN Token Ring	500 to 515
IBM PC LAN	455 to 485
Novell 2.15	530 to 535
3Com 3+Share	446 to 465
3Com 3 Open (with NetBIOS protocol)	495 to 500
Ungermann-Bass	350 to 485
(PS/2 machines need memory enhancer)	

Figure 2 - Memory Available with Typical LANs

eral memory management tools are now included, as is a special edition of A-T's Technotes with advice on their use.

DBCACHE is a disk caching utility that will work with either expanded or extended memory. It must be setup from DOS but is subsequently initiated by a call from within dBASE. A range of parameters include specifying the cache size, restricting to read only and enabling use with hot keys. A large cache, up to 1.6 MB, is advised for optimum performance and the 'spare' 384 KB on a 1 MB 80286 machine did not give much noticeable improvement.

More effective was use of the DOS environment variable to place temporary files on a RAM disk. SET TMP=<drive> will also be used by other software and if this is not required SET DBTMP=<drive> applies to dBASE only. A 512 KB disk is recommended and indeed a 300 KB temporary file is written as dBASE is first started. However, no problems were encountered using just the 384 KB available and it did improve some aspects of performance.

DBHEAP is another DOS environment variable that can be used to fine tune the optimum split of RAM between dBASE overlays and an application. See Figure 1 for details. A high setting will give extra space for a complex, programmed system. A low setting will minimise overlay swapping during intensive use of the Control Centre.

Does it go?

The performance of V1.1, in conjunction with these tools, would appear to be very dependent on the specification of your PC. They are of no help on a bog-standard XT and did not do much on the 10 MHz 80286 used for the tests. Set piece operations such as INDEX or TOTAL ON do return faster times in one-off tests but it still feels sluggish and a bit 'jerky' in normal interactive use. Just loading dBASE took 48 seconds, though use of the undocumented /T parameter saved six seconds and the RAM disk for temporary files another seven. Even a trivial task such as DIR to list 30

.DBF files took 20 seconds. Surprisingly, this dropped to nine seconds with the temporary files on the RAM disk but there was no discernible reduction with the disk cache. By comparison, dBASE III+ took 15 seconds to load and completed the DIR in five seconds without any use of RAM disk.

The indication from these timings was not encouraging. To establish if they were typical of everyday use, a widely-used accounts package, written entirely in dBASE code, was tested with V1.1. No problems were encountered, but you would need to be a very patient user to find its speed acceptable on anything less than a well-specified 386. Everything happened at snail's pace, with pronounced pauses at points where the same code, compiled with Clipper, gave an instant response. A complete re-index of 16 files, containing about 16000 records in all, took 240 seconds. True, this did involve identifying file names through macro substitution but, even so, compared badly to dBASE III+ (255 seconds). Clipper was more than twice as fast (105 seconds) and indeed was over three times faster on the main, 13000 record, file.

dBASE IV will now run on any machine with at least 640 KB, but for good performance would seem to need a fast processor and several megabytes of extra memory for caching and a RAM disk. It should also cope with most networks, providing they are not too greedy - see Figure 2 for examples of available memory. A-T has quietly buried the previous unimplemented facility to use spare memory above the 640 KB boundary, but suggests that a range of third party products such as QEMM386 and HiCard could be used instead.

Language Tweaks

Although the prime aim of V1.1 is to provide a fully usable product, some useful language enhancements have also been included. Figure 3 lists the more interesting changes. The previously available SAVE and RESTORE screen commands are now documented, a FOR clause can be added to an INDEX command for conditional indexing and REPLACE FROM ARRAY complements the existing COPY TO ARRAY. The BROWSE screen has a new 'Organise' menu option that allows indexes to be created or existing ones selected. This will be appreciated by many users. There are a wide range of improvements to the SQL capability including use of the Control Centre and the option of traditional dBASE commands in SQL mode.

There are several indications in the revised package that A-T are now more willing to allow experienced users to explore the full scope of what is available, even though it might prove risky for the unskilled. An example is the removal of many of the

CERROR() for compile time error no		
Conditional Index using FOR ...		
KEYBOARD	-	a type-ahead buffer
LKSYS()	-	enhanced features
RELEASE SCREENS	-	new command
RESTORE SCREEN	-	new command
SAVE SCREEN	-	new command
REPLACE FROM ARRAY	-	new command
REQUIRED	-	qualifies GET validation
SET()	-	returns SET settings
SET CURSOR ON/OFF	-	new command
SET DBTRAP ON/OFF	-	new command
SET DIRECTORY	-	new command
SET MESSAGE	-	enhanced command
WINDOW()	-	returns current window

Figure 3 - Summary of Language Enhancements

previous restrictions applicable to User Defined Functions (UDFs). They have however provided both guidance to sensible use and an optional Safety Net. This

uses a new SET DBTRAP ON/OFF command. dBASE regards many UDFs and ON commands (such as ON KEY LABEL F3 DO <procedure name>) as interrupt commands. A careless/inexperienced programmer might, for example, use one to remove the window that was active when interruption occurred - leaving no return path. Another example is the recursive use of BROWSE from within a BROWSE screen. Setting DBTRAP ON inhibits any use that might run dBASE into a logical brick wall. The guide notes describe it as a set of training wheels, for use until you are confident you can program a clean exit. A nice touch for the beginner. See Figure 4 for a list of unacceptable recursive calls.

Tate is no longer the leader in its field, and with V1.1 it has arguably not quite caught up with the opposition.

More important, perhaps, is that the competition is evolving from being a selection of look-a-likes to a range of similar (but distinct) approaches, built round a common file structure and core language. The corporates who prefer to keep with the big names can now safely move on from III Plus to IV. The thwarted network users need hold back no longer. For the rest, it is now a matter of choosing which package best suits your needs and your kit. You need no longer worry about 'will it work'. Yes, it will.

EXE

APPEND
ASSIST
BROWSE
CHANGE
CREATE<database file>
CREATE/MODIFY APPLICATION
CREATE/MODIFY LABEL
CREATE/MODIFY QUERY/VIEW
CREATE/MODIFY REPORT
CREATE/MODIFY SCREEN
EDIT
MODIFY COMMAND
MODIFY FILE
MODIFY STRUCTURE

Figure 4 - Prohibited Recursive Calls

Summing up

When dBASE IV was first announced, it looked a fresh and innovative product. Since then, FoxPro has been released with a more attractive appearance and, to many, a more intuitive approach. In the last few weeks, Clipper 5.0 has arrived, brimming with new tools for the skilled developer. Both FoxPro and Clipper run distinctly faster. Nor have the other database suppliers and dBASE clones stood still. So Ashton-

Bob Rimmington is an independent dBASE and Clipper consultant but with past experience as both a user and programmer in a large multinational. He can be contacted through Stanford Systems on 0444 236352.

dBASE IV V1.1 is supplied by Ashton-Tate (UK) Ltd, Oaklands, 1 Bath Road, Maidenhead, Berks, SL6 4UH. Tel 0628 775410. Its list price is £595, but discounts are available from many dealers.

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To Err is Computer

*Despite its popularity, MNP is still often misunderstood.
Aubrey Scoon prevents any errors...*

Many modern modems offer high data rates coupled with a facility for the detection and correction of errors to compensate for the poor quality of ordinary voice grade telephone lines. One such error detection/correction system has become widely established in common use: the Microcom Networking Protocol, or MNP. Most users of high speed modems on the public telephone network will be familiar with examples of MNP in practice.

Developed by the American modem manufacturer, Microcom Inc, MNP consists of a series of numbered data transfer protocols, often referred to as 'levels' or service classes. Broadly similar in principle to common file transfer protocols such as Xmodem, each MNP level offers a series of facilities, some fixed, some optional, that provide for efficient utilisation of the physical data link (hardware) available.

Say again?

The MNP protocol is an example of a system of error control known as Automatic Repeat Request or ARQ. Data to be transmitted is broken into blocks and sent down

the line with added checking information in the form of a Cyclic Redundancy Check (CRC). If the data is received correctly, ie if the CRC value transmitted with it matches its calculated value at the receiver, the receiver sends an acknowledgement to the transmitter. If the received data block has an error, the receiver does not send an acknowledgement, so the transmitter re-sends the last data block. The absence of an acknowledgement is assumed to be an automatic request for a repeat, hence the name. The process is repeated until either a correct data block is received or an arbitrary retransmission limit is reached. In the latter case, it may be assumed that the physical connection has failed and further attempts to retransmit would be useless. This same process is applied to all data flow in either direction, with the result that corrupted data is rejected and only 'clean' data blocks get through.

A key consideration in this process is that, unlike a traditional file transfer protocol, MNP should be transparent to the user. The user has no need to see it happening or be aware of its operation. Broadly speaking, the MNP protocol is implemented at the

Link and Physical layers of the Open Systems Interconnect (OSI) model. The only effect of MNP visible to the actual user (above the link layer) is the overhead of using the protocol itself and pauses in the data flow if corruption occurs on the line and a resend is in progress.

Service classes

Each service class of MNP theoretically offers higher transfer efficiency than the last, based on better ARQ algorithms, superior hardware facilities or both. Each class also incorporates any special features of those below it. The main ones in common use are classes 1 to 5.

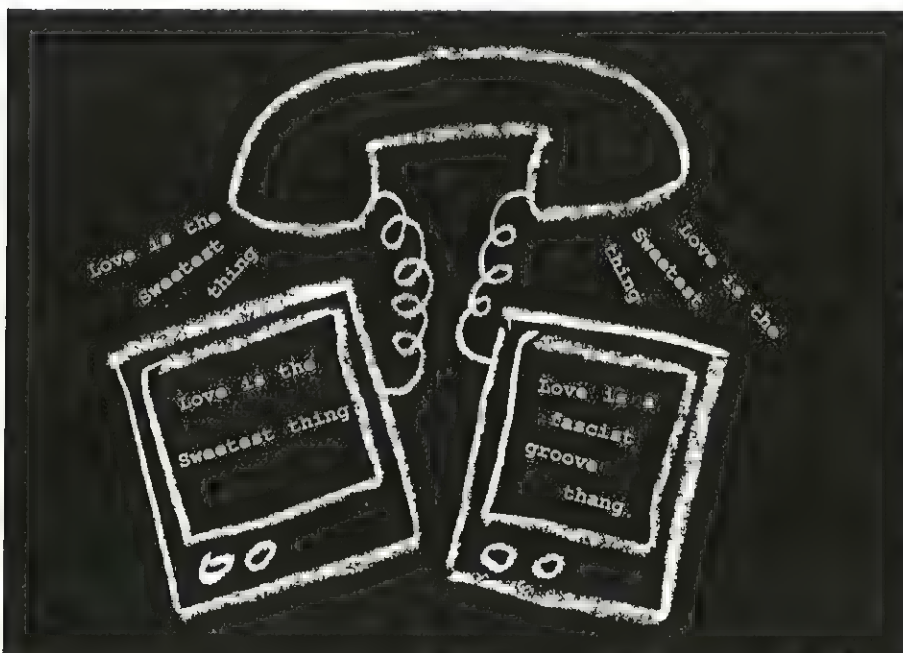
Class 1 is for use with half duplex asynchronous hardware and offers approximately 70% transfer efficiency on an error free line.

Class 2 is a full duplex asynchronous protocol offering efficiencies of the order of 80%.

Class 3 uses full duplex synchronous transmission. By using a synchronous data link, data bytes can be transmitted without the stop and start bits required by asynchronous hardware. This results in an automatic 20% improvement in transfer speed over asynchronous modes, since only eight bits need to be sent per byte, not 10. This added efficiency is offset by the overhead of the protocol itself, resulting in typical net efficiencies of the order of 110%. Aside from synchronous operation and its associated differences in packet format, class 3 is identical to class 2.

Class 4 can be optionally either synchronous or asynchronous as the available hardware permits. Ideally it uses the synchronous mode. At this level two special features are introduced, Adaptive Packet Assembly and Data Phase Optimisation.

The idea of Adaptive Packet Assembly is to vary the size of the transmitted data packets in accordance with link conditions. If the



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link is error prone, (a bad telephone connection, for example) the packet size is reduced accordingly, thus increasing the probability of it getting through before corruption occurs. On a clean line, larger packets may be used and efficiency will be higher, since more data in proportion to control information is sent in each packet. The MNP specification does not define an algorithm for Adaptive Packet Assembly. The algorithm used is left entirely to the implementor of the protocol, thus providing maximum flexibility.

Adaptive Packet Assembly is extended with Data Phase Optimisation. In the previous MNP classes, the maximum possible user data block size was 64 bytes in stream mode and 260 bytes in block mode (stream and block modes are described below). Data Phase Optimisation allows the class 4 link to renegotiate for a maximum stream mode data size of 256 bytes. In synchronous mode the efficiency of a class 4 implementation is approximately 116%.

Class 5 is also optionally synchronous or asynchronous and incorporates Data Compression. The compression algorithm uses a form of adaptive Huffman encoding. This results in variable efficiency, depending upon whether the data to be transferred is already compressed or not. Huffman encoding works by reducing the number of bits required to specify a character in proportion to its frequency of occurrence. So a character that occurs often in the data stream may be represented in as little as 2 bits. Less frequent characters will require greater numbers of bits. As long as the proportions between character frequencies are disparate, the algorithm will result in the data being represented in fewer bits overall. For textual data this is ideal, some letters occur much more frequently than others (eg the letter 'e' and space characters). In addition, textual data rarely uses more than 127 ASCII codes, so fewer and shorter Huffman codes are required all round. The net result is high compression efficiencies.

Unfortunately, the picture isn't as good for data that has already been compressed. The data output by methods such as Lempel-Ziv or Storer-Szymanski compression often contains a reasonably even spread of characters across the entire 8-bit range. Under these conditions, the advantages conferred by representing some characters in fewer bits is rapidly neutralised, and usually exceeded by the increased number of bits required for others. The net result in this case is that the data becomes larger. More data takes longer to transfer, so sending pre-compressed data under MNP 5 can almost totally negate the speed advantage

conferred by using a synchronous link. In asynchronous implementations this becomes a major disadvantage, effectively limiting throughput to class 2 efficiencies.

At any point in time the remaining number of free buffers is called the 'credit'

For text data, the transfer efficiency under MNP 5 is typically of the order of 200%. With compressed data it is typically around 102%.

Classes 1 to 4 of the MNP specification have been released into the public domain and subsequently have been incorporated into the new CCITT V42 specification for Error Correction Protocols. MNP class 5 is still licensed by Microcom to specific OEMs. Microcom has also produced a number of new service classes above class 5. These are comparatively rare - they are usually only present in Microcom's own modems. Among other features, the higher service classes offer support for a high speed half duplex V29 link with demand based turn-around

(class 6) as well as additional features such as improved data compression algorithms.

Parameter Negotiation

All MNP levels use a single administrative structure for their operation. Aside from simplicity, this allows any MNP implementation to establish a connection with any other, regardless of their respective service classes. This means that an advanced system may offer MNP class 5 support, yet still allow access via a simpler system that only supports class 2 operation.

When MNP implementations establish a connection, each side reports its capabilities to the other. At this point, both sides use a common algorithm to determine the highest specification they can mutually support. This is Parameter Negotiation, so-called because the two ends of the MNP link are effectively negotiating over the type of connection they will establish. Ideally, and usually in practice, each side will determine the best possible mutual settings, and then establish a connection of that type. In the rare event that they fail to reach agreement on the setting of a particular parameter, either side will drop the attempt to make the connection and signal the other appropriately.

Five parameters are considered during this negotiation activity. The most obvious of these is the actual service class to use. This will be the highest that each side can mutually support. So in the above example of a class 2 implementation calling one at class 5, the mutual link will be established at class 2.

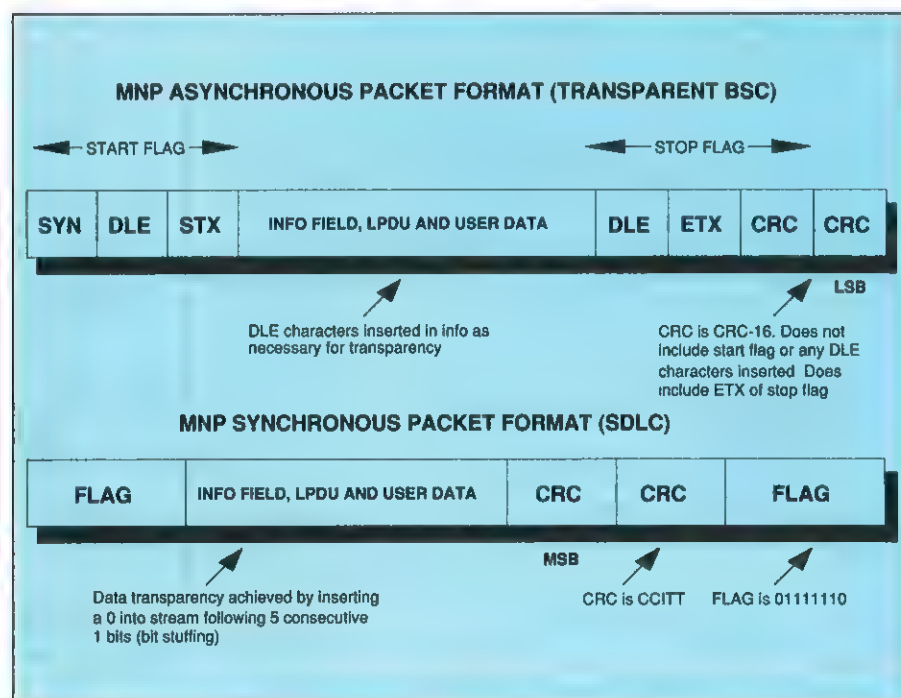


Figure 1 - The MNP Packet Formats

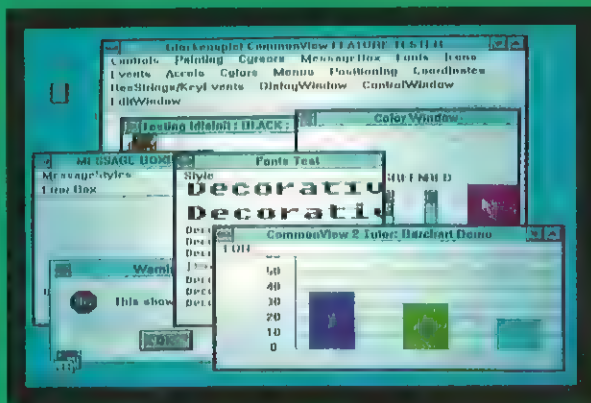
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The second negotiated parameter is the serial number check. Serial numbers are allocated according to a simple selection algorithm. Any particular implementation of MNP may optionally select whether to establish a link with any other on the basis of whether its serial number is valid according to the selection rules.

The third is the protocol level. An MNP implementation optionally supports one of two protocol levels, minimal or standard. The standard level allows all services that the link can support. In minimal mode, two services are omitted, stream transfer and the attention service. Stream transfer is simply the option to send data at any time in large data blocks of arbitrary size (provided they are less than the maximum block size below). When stream transfer is not supported, the data is usually assembled into fixed size blocks before transmission, and hence is called block mode. Standard mode MNP also offers the user an optional 'attention' signal that one side can send to the user at the other.

The standard mode is most useful for interactive work, where the data flow will be unpredictable. The minimal mode is better suited to automated batch or file transfers.

The fourth negotiated parameter is the initial transmitter credit allocation, described below. Finally, the maximum block size (ie the maximum amount of user data that may be transmitted in a single block) is also negotiated.

For the most part, the negotiation involves simply selecting the smaller or lower of the two values supplied by each side. The opposite applies to the maximum block size.

Link Protocol Data Unit

All data exchanged during an MNP communication session is transmitted in the form of Link Protocol Data Units (LPDUs), which are fixed data record types. The LPDUs are transmitted, together with parameters and the user data as appropriate, as the data field in one of two packet formats. In asynchronous modes, the packet format is that of transparent BSC, the IBM Binary Synchronous Communications format. In Synchronous modes, the packet format is similar to that of IBM SDLC (Synchronous Data Link Control). Both are illustrated in Figure 1.

There are six types of LPDU. Each one performs an overall class of function within the MNP protocol, has a fixed header (indicating the LPDU type) and a fixed and/or variable parameter part that defines one of

a number of sub-functions in each case. The LPDU types are:

1) Link Request (LR). This LPDU type handles the initial connection phase of the MNP link, and carries the data for parameter negotiation.

Unlike a traditional file transfer protocol, MNP should be transparent to the user

2) Link Disconnect (LD). This performs the function of shutting down and disconnecting the MNP link. It may also be used to reject an attempt to establish a connection, for example, if the parameter negotiation fails.

3) Link Data (LT). This is the LPDU that carries the actual user data back and forth across the link. Its format is shown in Figure 2.

4) Link Acknowledgement (LA). This performs the acknowledge function required for ARQ operation. It also carries the credit status for flow control.

5) Link Attention (LN). Used to signal attention to the other user of the link. This may be issued in one of three ways:

- To cause an immediate effect at the expense of any data in transit (ie in the receive buffers) called an expedited destructive LN.
- To cause an immediate event without disturbing data in transit, called an expedited non-destructive LN.
- To wait its turn for transmission in the course of normal data flow. This is a non-expedited, non-destructive LN.

6) Link Attention Acknowledgement (LNA). A signal to acknowledge receipt of the LN LPDU.

An MNP implementation has a number of timers used for flow control and time-outs. Transmission of specific LPDUs will set or

reset specific timers. For example, there is an inactivity timer (usually 59 seconds) that will cause a Link Disconnect event if an LT LPDU has not been transmitted within this period. For this reason, MNP implementations often transmit 'dummy' LT LPDUs if no user data is available at any particular time.

Establishing a link

The sequence of events for establishing an MNP link is straightforward. The initiator sends an LR LPDU to the acceptor, containing its negotiable parameters. The acceptor compares these parameters with its own using the fixed negotiation sequence. This results in a set of 'compromise' parameters which the acceptor now checks. If all the compromises are acceptable to it, it returns an LR LPDU to the initiator with its own parameters. If the compromise is not acceptable, it will not send the LR LPDU but will terminate the attempt by sending an LD LPDU instead, and will disconnect.

The initiator will then receive one of two things from the acceptor. If it receives the LD LPDU, it terminates the attempt and disconnects. If the acceptor has sent an LR LPDU, the initiator will perform the parameter negotiation sequence and derive the compromise set for itself. If the compromise is not acceptable to the initiator, it will terminate by sending its own LD LPDU. If the compromise is acceptable, it will respond with an acknowledgement in the form of an LA LPDU. (This reads much better as a case statement than in English.)

In the event of corruption of data during the connection phase, the initiator will wait for a response for a certain time. If the response does not occur, or if the response is garbled, the initiator will resend its original request and reset the timer. If the same thing happens again, the initiator will give up and terminate. An identical process occurs at the acceptor.

If all has gone well during the connection phase, the link is established and it now enters the data phase. The link establishment sequence is always performed in asynchronous mode. Any switch to synchronous mode will occur automatically at the beginning of the data phase. At any point the MNP connection may be terminated by either side by sending the other an LD LPDU.

The data phase is characterised by the exchange of LT LPDUs and the corresponding acknowledgements (LA LPDUs) between the two parties. The user data is attached to the end of the LT LPDU and passed with it.

The basis of the data phase operation is the ARQ scheme described earlier. However, MNP offers an improvement over that simple scheme.

Window into the world

MNP incorporates a system known as 'windowing'. The idea is that the line bandwidth may be utilised more efficiently if the transmitter does not wait for the acknowledgement before sending the next block of data. The transmitter sends blocks continuously without an acknowledgement, up to a fixed limit or 'window'. The received blocks are stored by the receiver, so the window effectively represents the number of receive buffers available. At any point in time the remaining number of free buffers is called the 'credit' allowed to the transmitter.

During normal operation, with no corruption of the data, the transmitter will receive regular acknowledgements (LA LPDUs) that keep pace with the blocks it is sending and the transfer will be continuous. On a half duplex line, the receiver will have to wait for a transmission pause to send the acknowledgement, while on a full duplex system it will send the acknowledgements on the back channel simultaneously with the data transmission. Each LA LPDU carries the current credit value back to the transmitter. The window allows the receiver to collect several blocks before an acknowledgement event becomes necessary, and so the transmitter can keep sending instead of waiting around for the acknowledgement to arrive. In this way the data flow is more or less continuous.

In a half duplex system, this can reduce the number of turn-arounds required, as sev-

eral blocks can be acknowledged at once, in a single transmission of several LA LPDUs. If data is corrupted, the receiver will stop sending acknowledgements and the transmitter will stop sending new data when its credit runs out. It will then wait for a time specified by an LT retransmission timer. Upon time-out, it will start to resend the data blocks, starting from the last one that has not been acknowledged. If the acknowledgement for the blocks being resent arrives at this point, the resend is discontinued after the current block and transmission of the next set of data commences. Or the resend of the first unacknowledged block, as appropriate. At the receiver end, any unnecessary data sent by the transmitter is ignored. In this way, corrupted data is resent as necessary. If the line is so bad as to require more than 12 retransmits of a given LT LPDU, then a Link Disconnect event is initiated by the transmitter.

Another timer keeps track of the time between the sending of LA LPDUs. The LA LPDU contains information on the current credit, so as the receive buffers are emptied, the credit value changes. LA LPDUs are periodically sent to the transmitter with the current credit level, whether there is an LT LPDU remaining to be acknowledged or not. To avoid credit errors, the transmitting implementation will perform a running calculation of the amount of credit by subtracting one from its known value every time it sends another LT LPDU. The LA LPDU credit value, therefore, acts as a correction if the transmitter loses track of its credit. In this way the system of credit also provides a method of flow control handshaking between systems of different processing speeds. To stop the transmitter from

sending at any point in time all the receiver has to do is to send it an LA LPDU with a credit value of zero.

When the data phase is concluded and all data transferred, the initiator may terminate the link with an LD LPDU. The LD LPDU has a parameter which allows a user definable byte to be sent with it. This usually is used to carry a 'reason code' ie an agreed binary value that indicates the reason for the termination. In this way the receiver of the LD will know what caused the transmitter to terminate the connection. If the LD LPDU is sent too early it can cause loss of data, as it will automatically cause any remaining unread data in either party's receive buffer to be discarded.

Conclusion

The Microcom Networking Protocol offers a scheme for the transmission of data between sites which is flexible and efficient, yet easy to implement. The incorporation of service classes 1 to 4 into the CCITT V42 specification has secured its position as the 'de facto standard' for error detection and correction schemes.

EXE

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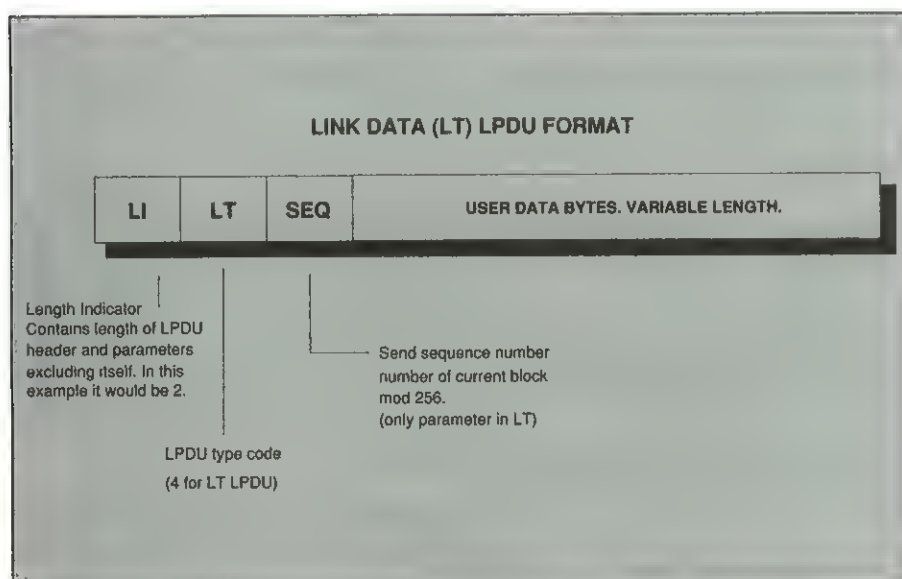


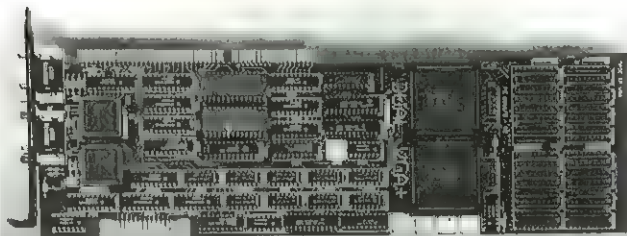
Figure 2 - The LT LPDU Format

Aubrey Scoon is a freelance Consultant Systems Engineer, working in both software and hardware fields. A regular BBS user, he runs free technical help forums on Mission Impossible (0602 654329) and Hawk's Castle (0344 411621) BBS.

The author wishes to thank Gregory Pearson of Microcom Inc for providing a copy of the MNP specification. Microcom Inc can be contacted on 0101 818 986 4212, or by writing to 500 River Ridge Drive, Norwood, Massachusetts 02062-5028, USA. Readers may like to know that the company has produced a public domain library of functions for MNP implementors in a variety of programming languages, including C.

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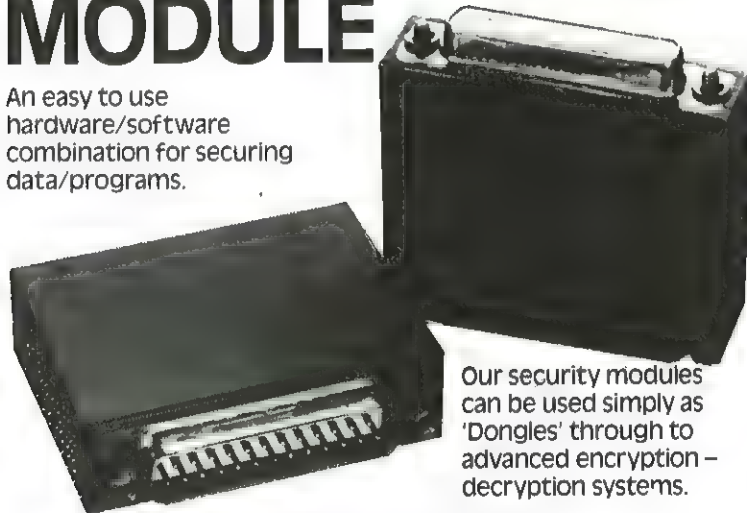
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The Language that Would Not Die

So what's new about object-oriented programming? Not a lot. Ron Kerr puts this fashionable topic into historical perspective.

Nearly 23 years ago, I decided to move from a secure job in the British aircraft industry to the Norwegian Computing Centre in order to work on the implementation of a programming language called 'SIMULA'. My boss could not comprehend why I had chosen to move to a foreign country to work on what he called 'a dead language'. That was the first occasion on which I heard SIMULA described as 'dead', and reports of its demise have arrived repeatedly ever since. SIMULA has evidently suffered the most protracted death throes of any product in the history of our profession!

Since the arrival of block-structured programming languages, probably the most significant development in software design and construction techniques has been 'object-oriented' programming which is currently riding the crest of a wave of enthusiasm from both technical and entrepreneurial quarters. SIMULA was the first object-oriented language. In the words of Michael Caine, 'Not a lot of people know that'. SIMULA laid down most of the principles now accepted as essential elements of object-oriented programming. At a time when it may appear that the American soft-

ware evangelists are bringing their latest 'religion' to Europe, make no mistake - object-oriented programming is European!

SIMULA has profoundly influenced virtually all the major object-oriented languages. The principal designer of Ada was a SIMULA compiler implementor. Smalltalk owes its existence to Alan Kay, a visionary inspired by this obscure language from Norway. C++ is the outcome of Bjarne Stroustrup's frustration at C's lack of SIMULA's expressive power. Eiffel was designed by Bertrand Meyer, a major industrial SIMULA user and one-time chairman of the SIMULA user association.

The word 'SIMULA' suggests simulation. Indeed, an early version of SIMULA addressed the particularly complex problems of dynamic simulation modelling. However, the principles established by the early work - now termed 'object-oriented' - were found to be valid for general software development. Modern users may prefer to think of SIMULA as an acronym for **S**IMPLE **U**niversal **L**ANGUAGE. Many years ago, one sceptic had the temerity to suggest to SIMULA co-designer Kristen Nygaard that the language was not a general-purpose programming language at all. Nygaard's riposte: 'FORTRAN and ALGOL are generally accepted to be general-purpose. SIMULA has their capability plus a good deal more, so what must be removed to make it general-purpose?'

The Triangle Problem

Followers of the 'Third Side' series will be aware that the 'Triangle Problem' is a recurrent theme through which language features can be illustrated and contrasted. For three reasons, it is an inadequate vehicle for describing SIMULA. First, SIMULA is an almost pure superset of ALGOL 60. The triangle problem could have been coded in a form indistinguishable from ALGOL, re-

```
begin integer sides_per_triangle=3 ;

class triangle ;
begin real array sides(1 : sides_per_triangle) ;
  integer side ;
  text type ;

  procedure display ;
  begin outtext("Triangle entered:") ;
    for side:=1 step 1 until sides_per_triangle do
      outfix(sides(side), 3, 8) ;
    end of procedure display ;

  outtext("Enter three lengths:") ;
  outimage ;
  for side:=1 step 1 until sides_per_triangle do
    sides(side):=inreal ;
  type:-if sides(1)>sides(2)+sides(3) or else
    sides(2)>sides(3)+sides(1) or else
    sides(3)>sides(1)+sides(2) then "not a" else
    if sides(1)=sides(2) and then
      sides(1)=sides(3)
    then "an equilateral" else
    if sides(1)=sides(2) or else
      sides(2)=sides(3) or else
      sides(3)=sides(1)
    then "an isosceles"
    else "a scalene" ;

end of class triangle ;

ref(triangle) T ;
T:=new triangle ;
T.display ;
setpos(pos+4) ;
outtext("This is " & T.type & " triangle.") ;
end
```

Figure 1 - The Triangle Problem

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RSTS/E, RT-11 and RSX-11M PLUS versions released for DEC PDP-11.

1982: Terminal emulation facility introduced enabling the use of a terminal on a local computer as a terminal on a remote computer thereby allowing control of file transfer sessions from a single terminal.

TSX PLUS version released for DEC PDP-11.

1983: Option to control file transfers from command files as an alternative to control from operator's keyboard.

P/OS version released for DEC Professional.

1984:

Mechanism built into the package protecting against "message bouncing" due to line noise when computers remain connected and the package is not in use. MicroRSX and MicroRSTS versions released for DEC MicroPDP-11.

1985: Commenced development of new portable versions written in the programme language 'C'.

1986: First releases of new portable versions written in 'C' for PC-DOS, MS-DOS, UNIX, AIX and VMS.

1988: PC versions enhanced with improved terminal emulation including VT100 emulation, keyboard mapping and facilities to define function keys.

1987: Portable versions support simultaneous multiple links. IPL-11 wins ICP Million Dollar Award.

1989: Comprehensive upgrade for unattended operation of multiple PC/host links supporting auto-dialling modems.

1990: Release of MULTI-POLL range of polling software incorporating IPL-11 allowing PCs or other computers at multiple sites to be telephone-pollled by a central host computer system to transfer data to and from the central system.



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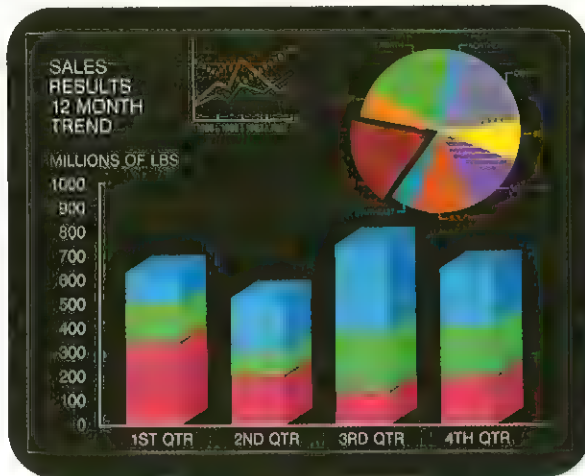
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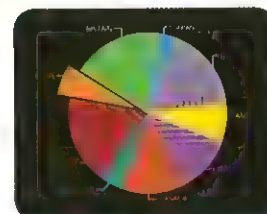
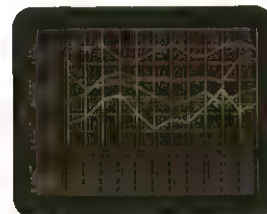
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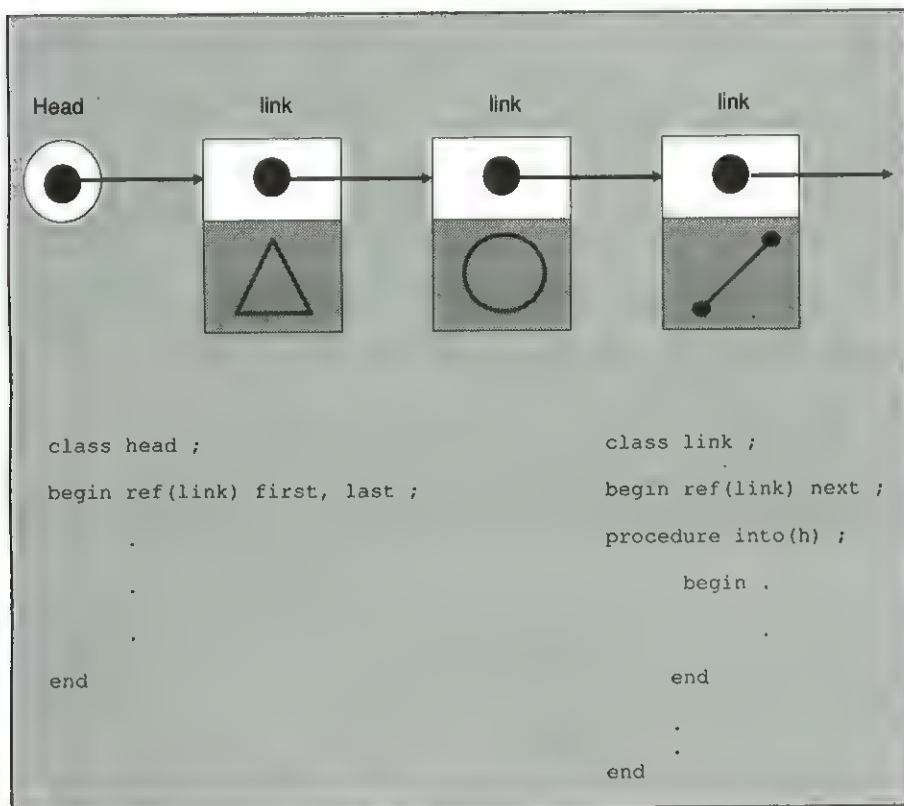


Figure 2 - A Simple Linked List

vealing nothing at all about SIMULA. Second, the simplicity of the problem gives little scope to exercise the rich object-oriented features which support the description of systems which are both structurally and conceptually complex. Third, the prescribed form of solution leads to a program structure which does not conform to the natural SIMULA style. Nevertheless, I have attempted to code a solution (Figure 1) in something resembling SIMULA style - I will elaborate on this later.

Programmers of my generation will recognise the basic ALGOL constructs used in the program: blocks, procedures etc. Storage

for arrays is allocated dynamically on block entry with lower and upper subscript bounds determined by the evaluation of arithmetic expressions. Procedures may be functions or 'proper' procedures. They pass data to and from their environment via parameters whose transmission modes may be by value, reference or name. ALGOL scope rules apply to the ALGOL-based constructs. Among several repetition constructs is the `for` statement, illustrated here, in which iteration is controlled by a variable incremented successively until a termination condition is satisfied. The elements of the iteration constructs may be general expressions which are repeatedly re-evalu-

```

class component;
virtual: procedure rotate, translate, ...
begin .
.
.
end

```

Figure 3 - A Geometric Component

```

link class component;
virtual: procedure rotate, translate, ...
begin .
.
.
end

```

Figure 4 - A Prefixed Class

ated, giving scope for great ingenuity. Particular forms of Boolean operations and `then` and `or else` are shown. These prematurely terminate the evaluation of Boolean expressions in situations in which the outcome is already known. SIMULA includes features for character and text string manipulation and upon these are built part of the input/output scheme.

These are rather elementary matters, and much less interesting than other features which embody the object-oriented style of system description. The solution recognises the fact that we are dealing with objects called `triangles` which have some form of representation, and properties expressing the contribution they make to the environment in which they exist. There may be many different types of object, each with properties uniquely associated with its own class and not possessed by other classes. In SIMULA, we attempt to identify the various types of objects we are manipulating and to classify them according to their properties.

Here, we have identified a class of triangles and, in its description, we have encapsulated all the properties of triangles we need in the context of the problem we are addressing - three sides, type (isosceles, scalene etc). We have chosen (or, rather, been requested) to represent a triangle by the dimensions of its three sides, stored in an array. Another property of the triangle is the ability to display itself, expressed as the procedural attribute (method) `display`.

In real life, we perceive objects intuitively. Some of these are entirely passive, like parcels in a postal depot; others, like postal workers, are active. Some may switch states between these two. This aspect of potential activity is preserved in our class definitions by providing an executable body. In this case, for any specific triangle object created, the body is used to solicit the dimensions of the sides and from these to deduce the type of the triangle. This could be regarded, here, as an initialisation process but, in other situations, it might represent autonomous activity in which objects, while interacting with others, possess also a degree of self-determination.

The execution of this program begins, as many do, near the end of the program text. A new triangle object is constructed according to the pattern of the triangle class definition. This contains the information structures necessary to distinguish it from other triangle objects. The body of the object is executed and the user is prompted for the side dimensions enabling the type to be computed. On completion of the


```

head class diagram ;
begin procedure rotate ;
  begin ref(component) c ;
    for c:-first, c.next ... do c.rotate ;
  end ;
  .
  .
end

```

Figure 5 - Representation of a Composite Diagram

body, the object remains and is identified by the reference variable T which, by the nature of its declaration, is permitted only to access triangle objects. Operations bound to the object can be executed on demand.

Classical O-O

So much for lip-service to the editorial edicts! Now let us look at triangles properly. Actually, this theme is not as inappropriate as I may have suggested earlier. One of the hurdles in converting traditionalists to object-orientation is that, since it really comes into its own in complex situations, it is difficult to demonstrate its benefits in terms of simple examples. Often the effort of understanding the problem distorts our appreciation of the power of the tools we use in its solution. From its earliest days, graphical examples have been used to demonstrate SIMULA's capabilities, largely because this topic is easy to visualise.

Consider an application area concerned with modelling the activities a draughtsman performs with pencil, ruler, compass etc. A geometric figure can be regarded as an assemblage of components which may be primitive geometric objects such as points and circles, or composite objects like polygons. We can say that a figure is composed of components which themselves may be composed of further components and so on. The computer representation of such a figure will, therefore, consist of some sort of aggregate structure each of whose elements represents a component. A flexible list structure is well-suited for this purpose.

We can conceive of various types of manipulation of figures, eg translation, rotation, resizing ... Any of these operations applied to a figure on the whole will involve the application of some form of the same operation on each of its individual components. Thus, the rotate operation of a complete figure will necessitate traversal of the list structure, applying an appropriate form of rotation to each component. Two observations can be made. First, techniques for traversing lists can be described in terms totally independent of the types of object their elements represent. Second, although

we wish to apply a rotate operation to each component, the mechanics of rotation will depend upon the nature of the object itself. For example, rotating a circle involves repositioning its centre while rotating a triangle involves repositioning its three apexes.

Since list structure and geometric issues are not really related, life becomes easier if we can temporarily separate them. The list processing problem can be solved by regarding a list as composed of a head to which are linked individual link objects (Figure 2). Procedural attributes, such as `into`, will contain the mechanisms for introducing and removing new objects and traversing the list.

The geometric aspects of the problem can be approached by introducing the concept of a geometric component (Figure 3). Although there will be many different types of component, they will all share certain abstract notions such as rotation, translation etc.

This will encapsulate all properties of components in general. The procedures `rotate`, `translate` and so on are specified as `virtual` because, although they represent notions relevant to the geometric 'level of abstraction', their implementation must be deferred to more specific definitions of the various types of component. Since we wish to express figures as aggregations of components, each component object has to be capable

of being a member of a list. This fact is expressed by writing class component (Figure 4) as a prefixed class which inherits all the properties of class `link`, its prefix.

At the same time, we wish to extend the notion of a list to reflect the fact that it contains geometric objects (Figure 5). In particular, we can express the fact that a diagram can be rotated and that this can be done by rotating its constituent components. This now permits us to program operations such as:

```

ref(diagram) drawing ;
drawing:-new diagram ;
new component.into(diagram) ;

```

This, in itself, is not useful - but illustrates how SIMULA can be used to factorise out the separate issues of the problem. The next step will be to add meaning to the component class. To do this we identify the various component types. These can be simple things such as circles, points, even triangles, and more elaborate objects with a non-trivial internal composition. We express this by elaborating class component in various directions (Figure 6).

Here we give the implementation of the `rotate` procedure for points and this is bound to the virtual specification supplied in class component. This means that we can manipulate the list structure representing a diagram and, for each component, the meaning of `rotate` will be determined by the precise nature of that individual. In object-oriented parlance, this is called 'dynamic binding', although SIMULA actually accomplishes it inexpensively at compile time.

Finally, Figure 7 shows a more object-oriented representation of triangles than the one we began with. The rotation of the triangle is accomplished by rotating its apexes. Incidentally, this is only a skeletal outline of how a drafting application could be tackled - you should not pay much attention to the fine detail.

```

component class point(x, y) ; real x, y ;
begin procedure rotate(phi) ; real phi ;
  begin x:=... ! Trigonometric functions
    y:=... ! of phi
  end of class point ;

  real procedure distance(p) ; ref(point) p ;
  begin ! Distance between this point and another, p ;
    distance:=sqrt((x-p.x)**2+(y-p.y)**2) ;
  end of procedure distance ;
  .
  .
end

```

Figure 6 - A Simple Geometric Component

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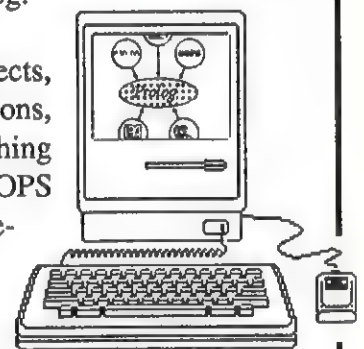
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CIRCLE NO. 351


```

component class triangle(a, b, c) ; ref(point) a, b, c ;
begin real array sides(1 : sides_per_triangle) ;
  procedure rotate(phi) ;
  begin a:-a.rotate(phi) ;
        b:-b.rotate(phi) ;
        c:-c.rotate(phi) ;
  end of procedure rotate ;
  .
  .
  sides(1):=a.distance(b) ;
  sides(2):=b.distance(c) ;
  sides(3):=c.distance(a) ;
end

```

Figure 7 - And So Back to Triangles

Ancient and Modern

In this short article, I have tried to show how, 23 years ago, SIMULA introduced the basic object-oriented concepts including encapsulation, inheritance, dynamic binding and autonomous activity (coroutines), the last not yet to be found in all modern object-oriented products. As a sop to its simulation heritage, the basic language sketched above is augmented by ready-made classes for performing list processing and discrete event simulation. These are constructed and employed according to the inheritance principles outlined here. In particular, the simulation class provides a general 'process' class containing the mechanisms for expressing the interaction between autonomous processes with re-

spect to simulated time. It is up to the user to extend this with the various activities processes perform and to express their synchronisation with other processes. Many practitioners in the simulation field believe that this is still the best tool available for heavyweight modelling.

Despite perpetual predictions of its imminent demise, SIMULA compilers continue to appear on an ever-increasing range of equipment, from mainframes, through modern workstations such as the IBM-PC, Sun and Macintosh, to what many have, until now, regarded as the lowly hobby end of the market, Atari. It is probably one of the most widely available of the object-oriented languages and, untied as it is to specialised hardware and operating sys-

tems, represents a most practical vehicle for bread-and-butter programmers venturing into the 'new world' of object-orientation. Moreover, SIMULA has supported, for 18 years, its own international user organisation with news-letter and annual conferences. It remains a mystery why this language, which has been so influential in so-called 'modern' software innovation, and which has shown such tenacity in survival, has itself attracted so little recognition in the international computing arena.

EXE

Ron Kerr is a systems programmer in the Computing Service at the University of Newcastle upon Tyne. By an accident of history he is arguably Britain's first object-oriented programmer.

If you would like to read more about SIMULA, he recommends The Development of the SIMULA Languages, a paper presented at the ACM SIGPLAN History of Programming Languages conference in 1978 by Kristen Nygaard, the father of object-oriented programming and co-designer of SIMULA.

If you would like information about the Association of SIMULA Users (of which Ron was, until very recently, the Secretary), then you can contact him at: University Computing Service, Computing Laboratory, The University, Newcastle upon Tyne NE1 7RU.

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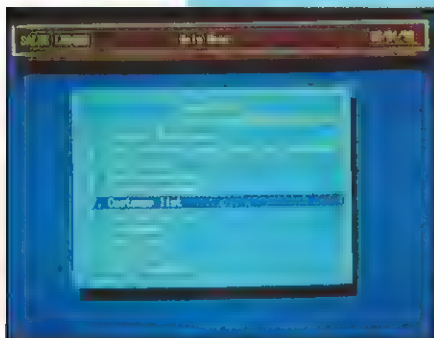
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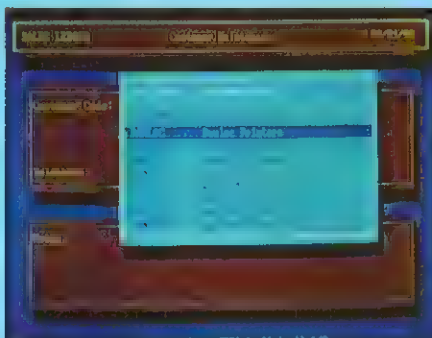
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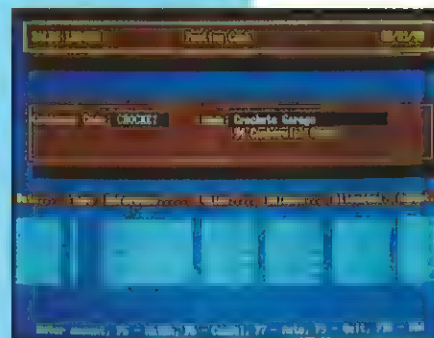
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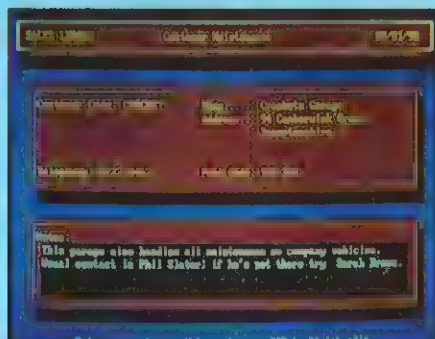
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CIRCLE NO. 355

Buffering the Mouse

If your application's mouse cursor is a little unwieldy, especially on slow machines, you need to build an event queue. Digby Prior explains.

Most computer users control software and enter data into their systems with a keyboard. However, in recent years the mouse has gained considerable popularity, and the pressure is now on the software writer to include mouse support in applications that were previously completely keyboard-bound.

It is comparatively straightforward to use the standard Microsoft mouse driver interface, based on interrupt 33h, to provide mouse support in your program (this inter-

***The solution is
the same as that
used by MS-DOS
to handle the
keyboard***

face is documented in, for example, *MS-DOS Extensions* by Ray Duncan, published Microsoft Press, ISBN 1-55615-212-4, \$5.95). However, one problem that you are likely to encounter, especially with graphics applications, is the inability of your program to keep up with the input from the mouse. The solution is the same as that used by MS-DOS to handle the keyboard. Whenever input occurs, you interrupt what you were doing, save the input in a queue and then carry on with whatever you were doing. When your program is

```
#pragma inline
#include "dos.h"
#include "graphics.h"

#define CURSOR 1 /* bit settings for setting up */
#define LEFTPRESS 2 /* up mouse interrupt mask */
#define LEFTRELEASE 4
#define RIGHTPRESS 8
#define RIGHTRELEASE 16
#define MIDDLEPRESS 32
#define MIDDLERELEASE 64
#define MOUSEQUEUEMAX 500 /* the size of the mouse queue */
#define FALSE 0
#define TRUE 1

struct mouse_queue_item_struct {
    int Button;
    int Column;
    int Row;
};

union REGS
{
    int DosReg;
    int MouseQueueFront;
    int MouseQueueRear;
    struct mouse_queue_item_struct MouseQueueItem;
    struct mouse_queue_item_struct MouseQueue[MOUSEQUEUEMAX + 1];
};

/***** Start of ResetMouse *****/
/* Description: This function checks if the driver is loaded */
/* If it is, it checks whether the mouse is */
/* responding, resets the mouse flags and */
/* returns the number of buttons */
/***** End of ResetMouse *****/
int ResetMouse (int *Buttons) {
    unsigned long address;
    unsigned char first_byte;
    address = (unsigned long) getvect(51);
    first_byte = *(unsigned long far *)address;
    if (address == 0 || first_byte == 0xCF) /* $CF = 207 = IRET */
        return(1); /* mouse software driver not loaded */
    else {
        DosReg.x.ax = 0; /* Microsoft mouse function 0 */
        int86(51, &DosReg, &DosReg);
        switch (DosReg.x.ax) {
            case 0 : return(2); /* mouse not responding */
            case -1 : *Buttons = DosReg.x.bx; /* mouse OK */
                    return(0);
        }
    }
    return(3); /* unexpected response code */
}
/***** End of ResetMouse *****/

/***** Start of ShowMouseCursor *****/
/* Description: This function displays the mouse cursor */
/* Corresponds to Microsoft Mouse Driver System Call 1 */
/***** End of ShowMouseCursor *****/
void ShowMouseCursor(void) {
    DosReg.x.ax = 1;
    int86(51, &DosReg, &DosReg);
}

/***** Start of HideMouseCursor *****/
/* Description: This function hides the mouse cursor */
/* Corresponds to Microsoft Mouse Driver System Call 2 */
/***** End of HideMouseCursor *****/
void HideMouseCursor(void) {
    DosReg.x.ax = 2;
    int86(51, &DosReg, &DosReg);
}

/***** Start of MouseGetPosBut *****/
/* Description: This function returns the mouse cursor */
/* position and the current button status. */
/* Corresponds to Microsoft Mouse Driver System Call 3 */
/* Input: AX = 3 */
/* Output: BX --> mouse button status */
/* CX --> horizontal cursor position */
/* DX --> vertical cursor position */
/***** End of MouseGetPosBut *****/
void MouseGetPosBut(int *ButtonStatus, int *Column, int *Row) {
    DosReg.x.ax = 3;
    int86(51, &DosReg, &DosReg);
    *ButtonStatus = DosReg.x.bx;
    *Column = DosReg.x.cx;
    *Row = DosReg.x.dx;
}
```

Figure 1 - Sketch Program with Mouse Event Queue

ready it reads the input from the queue.

The application presented here (Figure 1) illustrates this buffering concept. It is a simple sketch/draw program written in Turbo C V2.0. We will set the mouse driver so that each time mouse input occurs the event is saved into a circular queue. The program gets its input from the queue whenever it is ready, and it will not lose mouse input while it is doing other processing.

Four functions are of particular interest. SetMouseInterruptHandler() uses Interrupt 33h function 0Ch to inform the mouse driver which function to execute

when a mouse event occurs. MouseInterruptHandler() is the function that gets called. Events are placed in the MouseQueue (which I have set to hold 500 events before overflowing) by PushMouseQueue and removed by PopMouseQueue - these two functions look after the head and tail pointers, and create a 'circular' buffer in linear memory.

Because there is assembler code included in this program, it is not possible to compile it from within the Turbo C integrated environment. You must invoke the command line compiler and linker from the MS-DOS prompt, using the following commands 'tcc -c -mc Mouse8' and 'tlink MOUSE8

C:\TC\LIB\COC, MOUSE8, C:\TC\LIB\CC C:\TC\LIB\GRAPHICS'.

You will find that if you hold down a button and move the mouse around quickly, you can get ahead of what is happening on screen, but when you stop moving the mouse, the program will always catch up.

EXE

Digby Prior is the Technical Director of Pink Software, a South African software house. This article is a modified version of one originally printed in the South African computer journal BIT Magazine.

```

/***** Start of PushMouseQueue *****/
/* Description: This function pushes a mouse event onto
/* the mouse event queue.
/* Note 1: This routine is called from the mouse
/* interrupt handler and must execute as
/* fast as possible to allow the next
/* next interrupt to be processed.
/* Note 2: The queue is circular and events will be
/* overwritten if the queue fills up.
/*****
void PushMouseQueue (struct mouse_queue_item_struct *X) {
    if (MouseQueueFront == MOUSEQUEUEMAX)
        MouseQueueFront = 0;
    else
        MouseQueueFront++;
    MouseQueue[MouseQueueFront] = *X;
    /*** if the queue is full the rear has been overwritten ***/
    /*** and the pointer to it must be advanced ***/
    if (MouseQueueFront == MouseQueueRear)
    {
        if (MouseQueueRear == MOUSEQUEUEMAX)
            MouseQueueRear = 0;
        else
            MouseQueueRear++;
    }
}
/***** End of PushMouseQueue *****/

/***** Start of PopMouseQueue *****/
/* Description: This function shifts the pointer to the
/* rear of the mouse queue to point to the
/* next mouse event.
/*****
void PopMouseQueue (void) {
    if (MouseQueueRear == MOUSEQUEUEMAX)
        MouseQueueRear = 0;
    else
        MouseQueueRear++;
}
/***** End of PopMouseQueue *****/

/***** Start of MouseInterruptHandler *****/
/* Description: This function gets called by an interrupt
/* according to the mouse interrupt mask
/* settings. It pushes a mouse event onto
/* the mouse event queue.
/* Note: This routine must execute as fast as
/* possible to allow the next interrupt
/* to be processed.
/*****
void interrupt MouseInterruptHandler (void) {
    MouseQueueItem.Button = _BX;
    MouseQueueItem.Column = _CX;
    MouseQueueItem.Row = _DX;
    PushMouseQueue (&MouseQueueItem);
    asm pop bp /* this code is because an interrupt
    asm pop di /* service routine must preserve all
    asm pop si /* the registers. If you declare a
    asm pop ds /* function as "interrupt" in Turbo
    asm pop es /* C, the compiler will push all
    asm pop dx /* registers on entry to the function
    asm pop cx /* and will pop them on exit, using an
    asm pop bx /* IRET instruction to return to the
    asm pop ax /* program. We need to replace this
    asm retf /* IRET instruction with a RETF
}
/***** End of MouseInterruptHandler *****/

/***** Start of SetMouseInterruptHandler *****/
/* Description: This function sets the mouse interrupt mask
/* and redirects the mouse interrupt to the
/* specified interrupt handler.
/* Input: The mask has the following bit map -
/* Bit 0: Cursor position changed
/* Bit 1: Left button pressed
/* Bit 2: Left button released
/* Bit 3: Right button pressed

```

```

/* Bit 4: Right button released
/* Bit 5: Middle button pressed
/* Bit 6: Middle button released
/* Bits 7-15: not used
/* Note: OR the #defines values to create the
/* desired combination
/* e.g. CURSOR | LEFTPRESS | RIGHTPRESS
/*****
void SetMouseInterruptHandler (int Mask) {
    struct SREGS SegReg;
    DosReg.x.ax = 12;
    DosReg.x.cx = Mask;
    DosReg.x.dx = FP_OFF(MouseInterruptHandler);
    SegReg.es = FP_SEG(MouseInterruptHandler);
    int86x(51, &DosReg, &DosReg, &SegReg);
}
/***** End of SetMouseInterruptHandler *****/

void main (void) {
    int Button;
    int Column;
    int GraphDriver = DETECT;
    int GraphMode;
    int NoOfButtons;
    int Row;
    initgraph(&GraphDriver, &GraphMode, "");
    if (GraphMode == HERCMONOHI)
        poke(0x0040, 0x0049, 6);
    if (ResetMouse(&NoOfButtons)) {
        closegraph();
        puts("Mouse Software Not Loaded OR Mouse Not Responding.");
        exit(1);
    }
    if ((GraphMode == HERCMONOHI) || (GraphMode == EGAMONOHI))
        setcolor(WHITE);
    else
        setcolor(YELLOW);
    outtextxy(10, 10, "Hold down left button to draw, \
right button to clear, both to quit");
    MouseQueueFront = 0;
    MouseQueueRear = 0;
    SetMouseInterruptHandler(CURSOR | LEFTPRESS | LEFTRELEASE
                             | RIGHTPRESS | RIGHTRELEASE
                             | MIDDLEPRESS | MIDDLERELEASE);

    Button = 0;
    ShowMouseCursor();
    while (Button != 3) {
        if (MouseQueueRear != MouseQueueFront) {
            /* ie there is mouse input */
            PopMouseQueue();
            Button = MouseQueue[MouseQueueRear].Button;
            Column = MouseQueue[MouseQueueRear].Column;
            Row = MouseQueue[MouseQueueRear].Row;
            switch (Button) {
                case 1: HideMouseCursor();
                        lineto(Column - 1, Row - 1);
                        ShowMouseCursor();
                        break;
                case 2: HideMouseCursor();
                        cleardevice();
                        outtextxy(10, 10, "Hold down left button to \
draw, right button to clear, both to quit");
                        ShowMouseCursor();
                        break;
                default: moveto(Column - 1, Row - 1);
            }
        }
        /* The above code executes at a reasonable speed, but */
        /* let's assume that something more complex needs to */
        /* be done. This can be simulated by causing a delay */
        /* here.
        if (Button != 3)
            delay(20);
        HideMouseCursor();
        ResetMouse(&NoOfButtons);
        closegraph();
    }
}

```

Figure 1 - Sketch Program with Mouse Event Queue (Continued)

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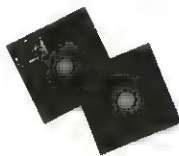
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CIRCLE NO. 358

BRENT

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BEWARE THE PIRATE'S PATCH

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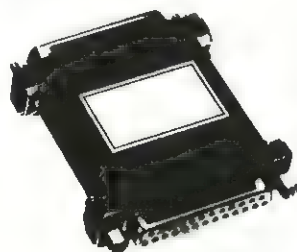
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CIRCLE NO. 357

Size is not Everything

Coherent is a PC-based UNIX clone which costs less than \$100. So what's the catch?

We asked our regular columnist Peter Collinson.

A 'virtual UNIX clone' for only \$99.95! I quote the words from the advert for Coherent UNIX from the Mark Williams Company. Claims are made like: 'fast, small, UNIX-compatible, everything UNIX was meant to do, only 10 MB of disk space. Everything you ever wanted in UNIX, for a lot less than you ever expected'. Does the product match the advertising?

I have seen these adverts for some time in the US press and was more than very interested to receive a copy for review. The great day came and it was with trembling urgent fingers that I passed my Swiss Army knife through the tape on the box. It slowly opened to reveal its contents: four floppy discs, one marked 'BOOT'; some odd bits of paper; a booklet marked 'Coherent Operating System Release Notes'; and a

great tome: 1.75 inches thick, over 1000 pages of book titled 'Coherent'.

Hardware

Ever since the earliest days, it has been necessary to look very closely at the hardware that the UNIX documentation says it supports, and then make sure that you get hold of the *exact* hardware from the list. Don't even think that a close approximation will work, it won't; and you will end up weeping the bitter tears of those made wiser by experience. Bearing all this in mind, read on....

Coherent is designed for the IBM AT, and can run on a machine that is totally compatible with the IBM AT. It will not run on micro channel machines, and to be fair, this

is said (in small type) in the adverts. You don't need any extra memory to run Coherent, it will run in 640 KB. The system must have at least one high density 3.5 or 5.25 inch floppy disk drive. Don't expect to be able to copy between the two different sized floppy formats using DOS, you must get the correct disks for your machine. You *can* copy the disks using Coherent, but you must be able to boot the system first.

The system must have a hard disk using an RLL or MFM controller. At present SCSI or ESDI disks are not supported, although drivers for these are coming along and a SCSI driver will be available in the next release. Existing registered users will get future releases at a very reduced price, so send in that card if you have a system.

Once running, the system supports interactive access through the console screen and keyboard, and also via the two serial ports COM1 and COM2. It will drive a printer through one of these ports or via the parallel port.

My first problem was to borrow some hardware to test Coherent; a local company came to my aid and lent me a Compaq 286, with 1644 KB of memory and a 20 MB hard disk. The monitor was monochrome, so I was unable to test the colour capabilities of the system.

Installation

Installation is painless and the instructions in the Release notes are easy to understand and follow. You need a magic number (on one of those bits of paper I mentioned) to allow you to proceed. You can re-install the system as many times as you like, and this I applaud.

At install time you have to make decisions about how much of your disk will be occupied by Coherent and how much by other operating systems like DOS and XENIX. I think that you may want to play with parti-

ATclock	cron	getty	mv	sum
UUCP	crypt	grep	ncheck	swap
ac	date	head	newgrp	sync
accton	db	help	newuser	tail
ar	dc	hpd	nm	tar
as	dd	hpd	nroff	tee
at	deroff	hpr	od	test
atrun	df	hpskip	passwd	time
awk	diff	icheck	phone	times
bad	diff3	if	pr	touch
badscan	dos	init	prep	tr
banner	drvld	install	ps	trap
basename	du	join	pwd	troff
bc	dump	kermit	quot	true
boottime	dumpdate	kill	ranlib	tsort
break	dumpdir	lc	rc	tty
build	echo	ld	read	ttystat
c	ed	lex	reboot	typo
cal	egrep	ln	restor	umount
case	enroll	login	rev	uncompress
cat	epson	look	rm	uniq
cc	eval	lpd	rmdir	units
cd	exec	lpr	sa	unmkfs
chgrp	exit	ipskip	scat	until
chmod	expr	is	sed	update
chown	factor	m4	set	wait
clri	false	mail	sh	wall
cmp	fdformat	make	shift	wc
col	fdisk	man	shutdown	while
comm	file	me	size	who
compress	find	msg	sleep	write
config	fixstack	mkdir	sort	yacc
continue	fnkey	mkfs	spell	yes
conv	for	mknod	split	yes
cp	fortune	mount	strip	zcat
cpdir	from	msg	stty	
cpp	fsck	msgs	su	

Figure 1 - Coherent Command Listing.

★ POCKET SIZED ★ PC-COMPATIBLE ★ PERSONAL ORGANISER ★



ATARI Portfolio

THE PC IN YOUR POCKET

The new Portfolio from Atari is the world's first pocket-sized electronic organiser that is also a powerful PC compatible computer, with a full QWERTY keyboard and scrolling 80x25 character display.

Portfolio includes everything you would expect from an electronic organiser - an address and telephone book, time manager, diary and sophisticated calculator.

Portfolio also includes several functions that you would not expect - a spreadsheet for your personal budget and expense records, as well as a text processor for typing memos and letters.

And, because Atari's Portfolio is PC compatible, it can communicate with your desktop PC at home, or in the office. You can transfer files from one to the other, to enable you to update your reports and figures with the Portfolio while you are on the move.

FOR ONLY **£199** INC VAT

SPECIFICATION

- ★ **Processor:** Intel 80C88 at 4.9152Mhz.
- ★ **Operating System:** Compatible with MS-DOS 2.11.
- ★ **Internal ROM:** 256K containing BIOS, operating system and applications suite.
- ★ **RAM:** 128K with an internal RAM disk, configurable from 8K. Externally expandable to 640K RAM.
- ★ **Keyboard:** 63 keys, QWERTY, IBM PC BIOS compatible. Buried numeric pad and function keys. Optional key click.
- ★ **Character Set:** Extended IBM ASCII (255 characters).
- ★ **Mass storage:** credit card sized memory cards (32K or 64K or 128K RAM).
- ★ **Display:** Graphics LCD, supertwist technology, MDA compatible, 40 columns x 8 lines, 240 x 64 pixels (with the option to window a full 80 x 25 character display). Keyboard controlled contrast.
- ★ **Peripherals:** 60 pin expansion BUS to take serial and parallel ports and memory expansion units.
- ★ **Size:** 8" x 4" x 1" (200mm x 105mm x 29mm).
- ★ **Weight:** 495 grammes (with batteries).
- ★ **Applications:** calendar and diary, address and phone book, Lotus 1-2-3 compatible spreadsheet, text processor, communications software.

5 BUILT-IN APPLICATIONS! TO GET YOU ORGANISED!

To get you started, Portfolio comes with a suite of five useful functions built-in, all accessible from a simple menu display.

TIME MANAGER

More than just an electronic diary, the Portfolio Time Manager enables you to plan your appointments via a comprehensive calendar and diary. It can even be programmed to sound an audible alarm at specific times to remind you of important appointments.

CALCULATOR

Your Portfolio will be invaluable in the office or at home as a powerful pocket calculator. It has a full range of functions, including factorial,

power and root calculations, all with multi display formats and memories.

ADDRESS BOOK & DIALLER

Portfolio has a complete address book facility that allows you to store hundreds of addresses and phone numbers. And, at the touch of a button, you can retrieve any one of them, or search for a specific grouping, such as "all Italian restaurants". And, when you are ready to book your table, hold your Portfolio to your telephone mouthpiece and use its special built-in tone dialler to dial the number for you.

TEXT PROCESSOR

The Portfolio's built-in text processor program

includes word wrap, line and column count, string search, in fact most of the functions you would find in a word processor. It handles printer and word processor control codes and allows easy transfer of files between Portfolio and your desktop PC.

SPREADSHEET

For real calculating power, Portfolio has a Lotus 1-2-3 compatible spreadsheet built-in. It has 127 columns x 225 rows and reads/writes Lotus V1.0 and V2.01 files, so you can transfer data to and from Lotus 1-2-3 on your desktop PC. The Portfolio's 256K ROM includes MS-DOS and PC BIOS compatible systems software.

COMING SOON!

In addition to the excellent software built-in to the Portfolio Free of Charge (see right), other software and peripheral products, such as the sophisticated Pocket Finance package and serial/centronics interfaces are available. And it doesn't stop there. Many manufacturers have recognised the potential of the Portfolio and have already started to design new peripherals and software. Products currently under development include: Serial interface with built in mini modem, Apple Macintosh interface, business, utility and programming software plus a range of adventure and battle strategy games. For further free details on the Portfolio range, fill in the coupon below and return it to Silica Systems now.



MEMORY CARDS

Portfolio can store and retrieve data and programs from its own RAM, or from small credit card size memory cards, that slot into its built in card drive. The cards are available in three sizes, 32K, 64K and 128K, so you can carry a library of data in your pocket. The card drive also accepts ROM cards, which can contain commercial or custom software.



POWER SUPPLY

Portfolio is powered by three AA batteries which will run for up to six weeks with normal use, or from the mains using an adaptor. All the peripherals take their power from the Portfolio, so no extra batteries or adaptors are required. A "battery-low" warning and memory back-up ensure that information is not lost when the batteries are changed.



INTERFACES & PERIPHERALS

Portfolio can communicate with other computers and supports a growing range of peripherals via a built-in 60 pin bus connector. Peripherals available include serial and parallel interfaces and memory expanders (to 640K). You can also add a card drive to your desktop PC, to enable it to read/write to Portfolio's cards.

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FREE OVERNIGHT COURIER DELIVERY: On all hardware orders shipped in the UK.
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PAYMENT: By cash, cheque and all major credit cards.
CREDIT PAYMENT TERMS: Silica is licensed credit brokers - details on request.

Before you decide when to buy your new Atari Portfolio, we suggest you think very carefully about WHERE you buy it. Consider what it will be like a few months after buying your Portfolio, when you may require additional peripherals or software, or help and advice with your new purchase. And, will the company you buy from contact you with details of new Portfolio products? At Silica Systems, we ensure that you will have nothing to worry about. Silica Systems is a new division of Silica Shop, the UK's leading Atari specialists. This new division has been established to provide a service to the more serious home user, as well as to business and education purchasers. Silica have been established for over 12 years, and have an annual turnover of £13 million. With our unrivalled experience and expertise, we can now claim to meet our customers requirements with an understanding which is second to none. But don't just take our word for it. Complete and return the coupon now, for our latest Free literature and begin to experience the "Silica Systems Service".

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CIRCLE NO. 359

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Mr/Mrs/Ms: ... Initials: ... Surname: ...

Address: ...

EXE10-90

Postcode: ...

Tel (Home): ... Tel (Work): ...

Company Name: ...

Which computer(s), if any, do you own? ...

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tion sizes and re-install things several times before you are happy with the disk layout. After you have copied all the files from the floppy onto the hard disk, you can install some user accounts with or without passwords. If you set things up without any passwords, you will miss some questions about setting passwords up on standard accounts. If you intend to use the COM1 or COM2 lines for remote access, you must ensure that the remacc login account has a password, which is achieved by issuing `passwd remacc` when logged in as super-user. Otherwise login attempts from the remote lines will fail; this is an undocumented feature. The system will run happily with no passwords set, but you are strongly advised to set passwords on everything if you intend to allow modem access *into* your machine.

You are also asked questions about the types of devices that you have attached to your system. This does a number of magic things to set things up, but hides the script that it uses. I hate this. If things change at a later date, it's hard to be convinced that something is properly installed without re-doing the whole system load again.

The install procedure will optionally load the manual system, advisable if you have the disk space. Finally, the dictionaries used for spell checking can be optionally loaded. At this point the system is completely installed.

Finally, you are presented with the option of taking a quick tour round the Coherent system; take it - you will not get another chance.

The Great Tome

The Great Tome is split just about evenly into two main 500 page sections: the first part consists of several tutorial style articles and the second a 'Lexicon'. There are a couple of articles on using and administering Coherent and then tutorial papers on `awk`, `bc`, `C`, `ed`, `lex`, `m4`, `make`, `MicroEMACS`, `nroff`, `sed` and `sh`.

The Lexicon is like an encyclopaedia, with lots of individual entries sorted alphabetically by keyword. When you require some information about anything, you simply think of a keyword and use this to index into the Lexicon. There are no special divisions of the data, so there is no section for commands, section for system calls and so on. All the information on every aspect of the system is described in one centrally indexed book.

The printed book is mirrored by the on-line copy, accessed by the familiar `man` command, that copies a file from the disk onto the screen. There is one file for every distinct entry in the printed Lexicon. The on-line copy has slightly more entries than the printed book, since it includes some omitted pages and the `uucp` documentation.

Every entry in the Lexicon has standard format, and this makes it easy to use. There is also a *See Also* section in many entries so it is possible to follow a chain of related items through the documentation. I think that the on-line copy is easier to use than the printed book, and it's a shame that there are no on-line copies of the papers at the start of the Great Tome.

I suspect that I would worry about the lifetime of a 1.75 inch thick book with a glued down back. It's big enough to lay flat open when in use, which is fine; but what happens when the back breaks and it starts disintegrating?

The Kernel

The basic system consists of a small memory resident kernel - using `size` on the binary shows 60 KB of program and 10 KB of data. When loaded, it prints a message saying how much available memory there is, so by subtraction the loaded system on my machine occupied 183 KB. It is possible to load specialised drivers, three are supplied to cope with System V type features: messages queues, semaphores and shared memory. If you want to write device drivers or see the code for the existing set, then you can buy a Device Driver Kit. The kit contains a relinkable kernel so you can add your new device drivers into your running system.

<code>abort</code>	End program immediately	<code>isatty</code>	Check if a device is a terminal
<code>abs</code>	Return the absolute value of an integer	<code>l3toi</code>	Convert file system block number to long integer
<code>assert</code>	Check assertion at run time	<code>ldexp</code>	Combine fraction and exponent
<code>atof</code>	Convert ASCII strings to floating point	<code>lib.b</code>	bc's function library (in bc source)
<code>atoi</code>	Convert ASCII strings to integers	<code>libcurses.a</code>	curses library
<code>atol</code>	Convert ASCII strings to long integers	<code>libl.a</code>	lex library
<code>calloc</code>	Allocate dynamic memory	<code>libmp.a</code>	Multi-precision arithmetic library
<code>candaddr</code>	Convert a <code>daddr_t</code> to canonical format	<code>libterm.a</code>	termcap library
<code>candev</code>	Convert a <code>dev_t</code> to canonical format	<code>liby.a</code>	yacc library
<code>canino</code>	Convert a <code>ino_t</code> to canonical format		Return from a non-local goto
<code>canint</code>	Convert a <code>int</code> to canonical format	<code>longjmp</code>	Convert long integer to file system block number
<code>canlong</code>	Convert a long to canonical format	<code>lto3</code>	Convert long integer to file system block number
<code>canshort</code>	Convert a short to canonical format	<code>malloc</code>	Allocate dynamic memory
<code>cansize</code>	Convert an <code>fsize_t</code> to canonical format	<code>memok</code>	Check if the arena is sound
<code>cantime</code>	Convert a <code>time_t</code> to canonical format	<code>mktemp</code>	Generate a temporary file name
<code>canvaddr</code>	Convert a <code>vaddr_t</code> to canonical format	<code>modf</code>	Separate integral part and fraction
<code>crypt</code>	Encryption using rotor algorithm	<code>rtype</code>	Return symbolic machine type
<code>ecvt</code>	Convert floating-point numbers to strings	<code>nlist</code>	Symbol table lookup
<code>endgrent</code>	Close group file	<code>peekl</code>	Copy a long from memory
<code>endpwent</code>	Close password file	<code>peekw</code>	Copy a word from memory
<code>exit</code>	Terminate a program	<code>perorr</code>	System call error messages
<code>fcvt</code>	Convert floating point numbers to ASCII strings	<code>pokeb</code>	Insert a byte into memory
<code>free</code>	Return dynamic memory to free memory pool	<code>pokei</code>	Insert a long into memory
<code>frexp</code>	Separate fraction and exponent	<code>pokew</code>	Insert a word into memory
<code>gcvt</code>	Convert floating point number to ASCII string	<code>qsort</code>	Sort arrays in memory
<code>getenv</code>	Read environmental variable	<code>rand</code>	Generate pseudo-random numbers
<code>getgrent</code>	Get group file information	<code>realloc</code>	Reallocate dynamic memory
<code>getgrgid</code>	Get group file information, by group id	<code>setgrent</code>	Rewind group file
<code>getgrnam</code>	Get group file information, by group name	<code>setjmp</code>	Perform non-local goto
<code>getlogin</code>	Get login name	<code>setpwent</code>	Rewind password file
<code>getopt</code>	Get a command-line option	<code>shellsort</code>	Sort arrays in memory
<code>getpass</code>	Get password with prompting	<code>sleep</code>	Suspend execution
<code>getpw</code>	Search password file	<code>srand</code>	Seed random number generator
<code>getpwent</code>	Get password file information	<code>swab</code>	Swap a pair of bytes
<code>getpwnam</code>	Get password file information, by name	<code>system</code>	Pass a command to the shell for execution
<code>getpwuid</code>	Get password file information, by id	<code>ttyname</code>	Identify a terminal
<code>getwd</code>	Get current working directory name	<code>ttyslot</code>	Return a terminal's line number

Figure 2 - Coherent C Routines and Libraries Listing.

THE ATARI ABC

Now, there's a PC-AT compatible that not only solves problems like other AT compatibles, it also solves the one problem that its predecessors have created ... affordability.

Silica Systems are pleased to present the new Atari ABC. The ABC is a 286 AT compatible that runs at over 5 times the performance of the IBM XT. This is achieved by combining the power and speed of a 16-bit 286 processor, with Atari Corp's development experience and engineering capabilities, which use the very latest in design technology. However, the Atari ABC's are available at 'XT prices' and many XT owners will wonder why they paid more, but got less!

The ABC is a reliable, high performance computer, built to exceptionally rigorous standards. It is well designed, to a state of the art specification, maintaining maximum expansion capability for the future. This includes up to 4Mb of RAM and 3 AT expansion slots. Plus, unusually for a PC at this price, the ABC has the ability to install two or three extra drives, with the cabling already inside the CPU.

The ABC has a host of impressive features, all built-in as standard, encouraging simple installation and ease of use. In addition, the ABC's small footprint and quiet operating, mean that you will notice it less on your desk than other PC's. Except, of course, when you begin to take advantage of its AT power.

At its remarkably low price point, the ABC is ideally suited for home, office and educational use and will take full advantage of the vast range of PC compatible software. And, with 12 months FREE on-site maintenance (8 hour response), you can rest assured that your ABC will be fully supported.

The ABC is the latest addition to a comprehensive range of both 286 (8Mhz or 12Mhz) and 386 (16Mhz and 20Mhz) PC's, from the Business Systems Division of Atari Corp. Atari's PC range offers an unsurpassed combination of reliability, compatibility and expandability, with unique features like Atari's 44Mb removable hard disk on their PC4. Return the coupon NOW for further details of the complete range of PC products from Atari's Business Systems Division.

**ABC
TURBO**
AVAILABLE: JUNE 90

To put the ABC even further ahead of the competition, we have introduced a special 'Turbo' version, which includes a super fast RLL hard disk controller to increase the data transfer rate from 150KBytes/s to 800KBytes/s, with a performance index of 4.801. Plus! to provide exceptional graphics with an outstanding colour resolution of up to 1024x768, we have included a Super VGA graphics adaptor and a 14" VGA colour monitor (which also supports 1024x768 resolution), all for an additional price of only £500. Check the ABC Turbo against the competition, at only £1299 (+VAT) with 30Mb hard disk, Super VGA colour graphics capabilities, plus 12 months on-site maintenance, it offers unbeatable value.

LOW PRICE - HIGH SPEC!

CPU + MOTHERBOARD	<ul style="list-style-type: none"> 8Mhz 80286 16-bit CPU Landmark Speed = 10.3Mhz, Norton SI Test = 9.0 Latest NEAT (New Enhanced AT) technology chip set Has user selectable bus, DMA speeds & wait states Programmable to operate at 0 or 1 wait states 640K RAM base memory (expandable) Motherboard expandable to 4Mb RAM memory Real time clock with battery back-up Full 16-bit data line capability Socket for 80287-8 numeric Co-Processor 3 16-bit AT expansion slots (max)
DISK	<ul style="list-style-type: none"> 32Mb RLL hard disk - 150KBytes/s transfer - 60ms access Fast disk controller - 800KBytes/s transfer - Turbo version 1.44Mb built-in 3 1/2" floppy disk drive Space for two 5 1/4" and two 3 1/2" drives (max)
I/O	<ul style="list-style-type: none"> Parallel port built-in (25-pin Centronics) Serial port built-in (9-pin RS-232) Mouse controller port built-in (9-pin serial)
GRAPHICS	<ul style="list-style-type: none"> Super VGA video graphics controller - 512K - Turbo vers Super VGA: 256 colours in 800x600 res - Turbo vers EGA video graphics controller built-in EGA: 16 colours available from a palette of 64 EGA: 256K of dedicated Video RAM built-in MDA, CGA and Hercules graphics controller built-in
PHYSICAL	<ul style="list-style-type: none"> Low noise operation Ergonomic small footprint (38cm x 41cm x 15cm) Keyboard - 102 key enhanced AT (12 function keys) Keyboard - has 2 position height adjusters
PLUS!	<ul style="list-style-type: none"> Fully OS/2 compatible (requires 4Mb RAM) Supports Industry Standard Networks MS-DOS 3.3 with GW BASIC 3.22 12 Months FREE on-site maintenance included

286 AT

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The kernel does not swap processes or program segments between memory and disk. The intention is that segment and process swapping should be managed by a user level process, although it does seem that a special driver is required to support the process. This is documented (in part), but not supplied on my version of the distribution. Technical support at Mark Williams says that the development of this is still in the pipeline.

The lack of swapping may appear to be a problem, but I found that I didn't run out of memory with my 1644 KB system. However, I suspect that you may experience trouble with a standard 640 KB system.

The kernel does seem fast. I am not in a position to benchmark it against an AT&T derived system, like SCO or Interactive. I have loaded it with work and it shows all the signs of having a fast kernel; at least its response to the keyboard remains good even when running several background jobs. It is certainly possible to be comfortably editing a file and compiling things in the background at the same time.

Standard Utilities

Coherent has a good set, maybe even a complete set, of the sort of fundamental commands that you would expect to find on a standard UNIX system. The flavour is Version 7 going on System V. The only surprise is the omission of a `vi` and the inclusion of `MicroEMACS` as the standard visual editor. My old friend `ed` is available

for single line edits or *in-extremis* file butchery. There are many commands that you would not have expected in a UNIX clone where AT&T source cannot be used; to my mind `awk`, `sed` and `nroff` fall into this category.

Without a long period of dedicated use, it's hard to see how good a job has been made of the basic utilities. There certainly are slight differences, and there are bound to be. The differences appear to happen 'at the edges' and may not matter to most users. I didn't come across any surprises while I was using the system.

Programming environment

High on my list of 'things to find out' was an answer to the question: how good is the programming environment? Can I use Coherent to compile and run my most loved public domain programs, allowing me to move my UNIX environment onto Coherent?

On the surface things seem good. Coherent has a C compiler, it isn't ANSI compatible - but then neither are most of my programs. The version of C supported is similar to many pre-ANSI C compilers; it has structure assignment, and supports the `enum` and `void` constructs. There are some of the standard UNIX programming utilities: `make` - the program compilation tools; `lex` - a program to create lexical scan routines suitable for insertion into `yacc` - yet another compiler-compiler. There is `m4`, a macro processor and `as` - an assembler for the target machine. There seem to be a good

set of UNIX compatible system calls and library routines.

I started by compiling that old stand-by, the program that prints 'Hello world'. To my horror, I found that typing the double quote character on the keyboard resulted in the character '@' being displayed on the screen. Those US folks haven't thought about funny keyboards like my UK one. After a phone call, it seems that support for keyboard mapping is present in the Device Driver Kit. Why *do* people mess around with key layouts?

Battling against hidden backslashes and unexpected '@' signs, I managed to get the program in. Next, I hopefully typed:

```
make hello
and found that make behaves like 'original'
V7 version and does not handle single targets. Instead, it says
make: can't open makefile
Oh well, no big deal. Using cc took seven
seconds to give me a running program and
I was happy.
```

I now went for the big one. I wanted to compile my favourite editor, `jove`. This is an EMACS style editor pre-dating `MicroEMACS`. The editor is up and running on most flavours of UNIX and even runs on my little portable DOS engine, so hopes were high. There followed much hacking of code and cursing, and I acquired several new facts about Coherent.

The `compress/uncompress/zcat` programs use a maximum of 12-bit com-

<code>_exit</code>	Terminate a process	<code>mount</code>	Mount a file system
<code>access</code>	Check if file can be accessed in given mode	<code>msgctl</code>	Control message operation
<code>acct</code>	Enable/disable process accounting	<code>msgget</code>	Get a message queue
<code>alarm</code>	Set a timer	<code>msgrcv</code>	Receive a message
<code>brk</code>	Change size of data area	<code>msgsnd</code>	Send a message
<code>chdir</code>	Change working directory	<code>open</code>	Open a file
<code>chmod</code>	Change file protection modes	<code>pause</code>	Wait for signal
<code>chown</code>	Change ownership of a file	<code>pipe</code>	Create a pipe
<code>chroot</code>	Change process's root directory	<code>ptrace</code>	Trace process execution
<code>close</code>	Close a file	<code>read</code>	Read from a file
<code>creat</code>	Create/truncate a file	<code>sbrk</code>	Increase a program's data space
<code>dup</code>	Duplicate a file descriptor	<code>semctl</code>	Control semaphore operations
<code>dup2</code>	Duplicate a file descriptor	<code>semget</code>	Get a set of semaphores
<code>exec1</code>	Execute a load module	<code>semop</code>	Perform semaphore operations
<code>execle</code>	Execute a load module	<code>setgid</code>	Set group id and user id
<code>execlp</code>	Execute a load module	<code>setuid</code>	Set user id
<code>execv</code>	Execute a load module	<code>shmctl</code>	Control shared-memory operations
<code>execve</code>	Execute a load module	<code>shmget</code>	Get the shared-memory segment
<code>execvp</code>	Execute a load module	<code>signal</code>	Specify disposition of a signal
<code>fork</code>	Create a new process	<code>sload</code>	Load device driver
<code>fstat</code>	Find file attributes	<code>stat</code>	Find file attributes
<code>getegid</code>	Get real group id	<code>stime</code>	Set the time
<code>geteuid</code>	Get effective user id	<code>stty</code>	Device-dependent control
<code>getgid</code>	Get real group id	<code>suload</code>	Unload device driver
<code>getpid</code>	Get process id	<code>sync</code>	Flush system buffers
<code>gtty</code>	Terminal initialization	<code>times</code>	Obtain process execution times
<code>getuid</code>	Get real group id	<code>umask</code>	Set file creation mask
<code>ioctl</code>	Device-dependent control	<code>umount</code>	Unmount a file system
<code>kill</code>	Send a signal to a process	<code>unlink</code>	Remove a file
<code>link</code>	Create a link	<code>utime</code>	Change file access and modification times
<code>lock</code>	Prevent process from swapping	<code>wait</code>	Await completion of child process
<code>lseek</code>	Set read/write position	<code>write</code>	Write to a file
<code>mknod</code>	Create a special file		

Figure 3 - Coherent System Calls.

pression - be careful when sending compressed files from other systems. I often move compressed tar images about, there does appear to be some compatibility problems between Coherent's tar of the program and the one on my Sun. The problems tend to give rise to error messages when reading, but I always managed to get the files unloaded from the tar file.

DOS support allows you to copy files from the Coherent partition onto an adjacent DOS partition on the hard disk, and I had no problems with this.

There are some problems with the C compiler. The compiler is not ANSI C compliant... yet it defines `__STDC__` - as zero. This causes compilation failure in all programs that depend on this *not* being defined. I believe that this actually violates the ANSI C standard. Of course, you cannot `#undef` the `__STDC__` variable, this aspect of the compiler closely follows ANSI C. Catch 22 is at work here.

The pre-processor defines COHERENT, fine - and not UNIX. Again this is a pain, Coherent's libraries are close enough to UNIX for the `#define` to be needed. Luckily, you are not prohibited from defining UNIX yourself. Actually, when I think about it, the word UNIX is pointedly absent in all the documentation and system files.

I had very little trouble with make; it read and seemed to cope well with all the makefiles that I fed it. I had a problem when I wanted to redefine one of the library rules, it complained about double definition rather than allowing the second definition to override the first.

I got to the end of code hacking and compilation of `jove` - and the final blow fell. Coherent only supports small model for the IBM architecture. I'll say it again. Coherent only supports small model for the IBM architecture. Mutter Mutter. I gave up on `jove`. Ah ha, this is the reason for all that 'Smaller, Faster' stuff in the adverts.

I decided to try some smaller programs. A public domain vi clone called `stevie` compiles and runs. It's not quite right, but it would not be difficult to integrate it into the system. I had no problem with a public domain `grep`. I tried my standard `yacc/lex` exercise that creates a simple calculator and this compiles and runs. I had to fight a little with the `yacc`, as Coherent's `yacc` is based on an earlier version of 'regular' `yacc` and the error recovery is different.

So, things look OK for program compilation as long as you can live with a small

model. The tools seem fine and are close enough to the real code so that you can skirt round the differences. The set of routines seem reasonably complete, there are some omissions: BSD's directory handling routines, for instance.

Text processing

Coherent offers the two standard UNIX text processing packages, the system supports `nroff` for fixed width output devices and its sibling, `troff`, that was designed originally to support typesetters. Coherent's version of `nroff` will drive impact printers like Epsoms, and `troff` only supports the HP LaserJet. I find this all rather disappointing. Why no PostScript?

The two programs can be used with two standard macro packages, the time honoured `ms` set and the set for manual pages, `man`. Coherent doesn't use the manual page set for its manual pages, they are supplied in plain text, although I suppose they could have started life as `troff/nroff` source. The various useful small preprocessors have not been supplied, so there is no `tbl` or `eqn` for example. There is a `spell` program supporting both English and American spellings.

The `nroff/troff` programs are quite a long way towards being compatible with their UNIX counterparts, but don't expect to move standard UNIX documents aimed at typesetters into the system and be able to process them. I did and got loads of 'Not implemented yet' messages. One reason for these was because the programs do not accept point size changes or special characters. In addition, the macro packages are not completely compatible with their UNIX equivalents.

In mitigation, it is possible that documents developed using Coherent will port into a 'real' UNIX system because this will be an upwards step. Trying to clone `nroff/troff` is not the easiest thing to do and, after all, other look-alike UNIX systems do cop out by electing to not to implement them.

I do feel that text processing is an area of 'could do better'.

External communications

Coherent comes equipped with a rather curious version of `kermi`, which does, however, work. I used to transfer several files in both directions down a direct RS232 line into my Sun. The code supports a 'client' end, and has not got the ability to become a server. I could envisage this being a prob-

lem. However, I would think that the standard public domain UNIX/C version of `kermi` will port onto the system.

In addition, a version of UUCP is supplied. It appears to be a late addition, and its manual pages are not present in the Great Tome, although they are available on-line. The second half of the Installation guide contains comprehensive UUCP setup instructions. These seem OK, although I tested all this using a direct machine-to-machine line, and setting this up was not very well documented. Coherent has a program, `uinstall`, designed to place text into the various UUCP control files, and this makes a lot of things much easier.

The UUCP seems to be a faithful clone, owing more to recent HoneyDanber versions of UUCP than older versions. It is supplied with autodial support for several modems, and configuration of new modems is easy - you just need to edit a file.

Some conclusions

On balance, I was pleasantly surprised by Coherent. It does feel like UNIX, and it is lively to use.

The biggest drawback is the C compiler's inability to generate anything other than a small model program. This rules it out for me because I would want to load several large public domain programs and systems - these simply will not fit. The Mark Williams Help Line did say that support for large model programs will be made available in the first quarter of 1991.

If you have a 286/386-based UNIX product that would be happy to run using a small model, then perhaps Coherent will provide you with a cheap license free platform. Mark Williams will drop the license price if you buy in bulk. I don't think that I would recommend it to someone who wanted to see what UNIX was like. If you know UNIX and C, and want a very low-cost UNIX look-alike to play with, then Coherent is perhaps for you.

EXE

Peter Collinson is a freelance consultant specialising in UNIX. He wishes to thank Kevin and Richard at Meduser Systems Ltd, Ashford, Kent for lending him a machine for much longer than originally asked.

Coherent, a UNIX look-alike for \$99.95 is available from the Mark Williams Company (0101 708 291 6700). There is a 60 day money back guarantee. The Device Driver Kit is \$39.95.

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Books

Pretty pictures, dirty hippies.

Words and Pictures

It must be tough being a computing dictionary compiler. Either you include definitions of words like 'input' and 'button', and risk derision by the experts, or else you can throw yourself into long and technical mini-articles, and risk losing everyone else. John Vince's book is the first I've seen that manages to pacify both camps. 'Input' is in there, as is 'byte', 'polygon' and 'isosceles triangle', but then so is 'Overhauser curve' and 'delta form-factor'. What's more, the author manages to splice everything together with enough relevant cross-references to pass from a definition of a CRT to frame-stores and texture maps in a couple of leaps. I picked up something from a cynical glimpse at the 'bit' entry: very embarrassing.

The book is only 175 pages long, but few of the descriptions are longer than 100 words, with any brevity due entirely to pith rather than skimpiness. Vince has been careful to include a long and wide-ranging table of references so that the items covered can be followed up if need be. It's this, I suspect, that makes it such a useful book: a lot of ground is covered, but never in overly technical detail. *The Language of Computer Graphics* knows what the CCIR 601 recommendations are about and where you can find them. If you want the minutiae, you'll have to uncover it yourself. This is just what is needed for the computer graphics field, where lots of cross-disciplinary dabbling makes broad overviews like this handy things to have, and also rather thin on the ground. John Vince steers away, too, from an undue concentration in his own field: often a bugbear in these books. (That said, he's not averse to dropping a few references to his own articles, either.)

I was hoping for some pretty pictures, but Vince resists this as well, damn him. There are, however, some very functional line drawings and a disturbingly organic-looking 3D fractal plot on the cover. All the illustrations are black and white, which makes some of the colour definitions a little circuitous. The obligatory Mandelbrot shot seems very humdrum in mono, too. This is not to say, however, that the book doesn't look good. It was originally published by the Architecture Design and Technology Press, and this shows in the well thought out, but unobtrusive layout. It's a useful book, rather than a coffee-table monster, and one that I can imagine will appeal to a wide range of people. Recommended.

Title: *The Language of Computer Graphics* Pages: 175
Price: £19.98 Author: John Vince
Publisher: Longman ISBN: 1 85454 147 1



The Boob Tube

Apple Computer, despite five years of corporate streamlining, loves to play up its hippy image. All the bosses wear jeans. It sponsors organisations like the Coincidence Institute, which seeks to understand how it is that you can think of something and then, like, it *actually happens*. All employees must play softball, all of the time. It produces hippy computers like the Macintosh. And it publishes books like this.

The Art of Human-Computer Interface Design is the sort of book that has chapters titled 'How I Learned to Stop Worrying and Love Hypercard: A First-Person Account of a Paradigm Shift'. Children are always referred to as kids, and television is the Boob Tube. All the contributors get their pictures at the back. At least three articles start with homely anecdotes about ma and pa. Dr Timothy Leary (of 'Turn on, Tune in, Drop out' fame) discusses his contribution to designing interfaces ('We studied the mind-transforming properties of LSD by booting-up divinity students, artists, prison inmates and ourselves'). Don Norman, the top interfaces expert (you can tell he's the expert, because he gets to write an article called 'Why Interfaces don't Work') is interviewed about 'the interface'.

"What do you think is most important about the interface?" I asked Don Norman.

"What do I think is most important about the interface?" he parried, with a puckish grin on his face, "Nothing. Everything."

Apart from Don, the most irritating aspect of this book is that it is not entirely dreadful. Hidden away between the articles by Michael Nimark, Media Artist and Brenda Laurel, Interactivist, is some genuinely thought-provoking research. The article by Gitta Salomon is an excellent discussion on how to use colour in a GUI.

Good points can be found, too, in a fascinating piece on the development of Pidgin languages, and a report on a MAC II interface designed for Koko, the gorilla who has learnt sign-language. Unfortunately these are just short pieces in a huge book, and all are marred by the mad California neologisms that appears to be Apple's house style.

I doubt anyone would get much further than the first page, which explains how empowerment itself is a notion which we must unpack, and how we must all attach our interfaces to bundles of functionality. Time, I think, to tune out.

Title: *The Art of Human-Computer Interface Design* Pages: 520
Price: £23.35 Author: Brenda Laurel, et al.
Publisher: Addison Wesley ISBN: 0-201-51797-3



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The Semantics of Programming Languages, by Matthew Hennessy.
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Windows v3: Programmers Reference.
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Prolog Programming for Artificial Intelligence (Second Edition), by Ivan Bratko.

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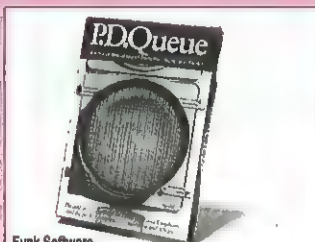
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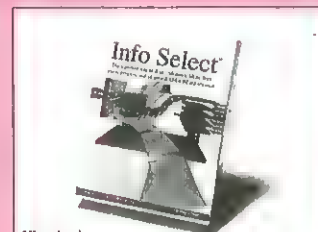
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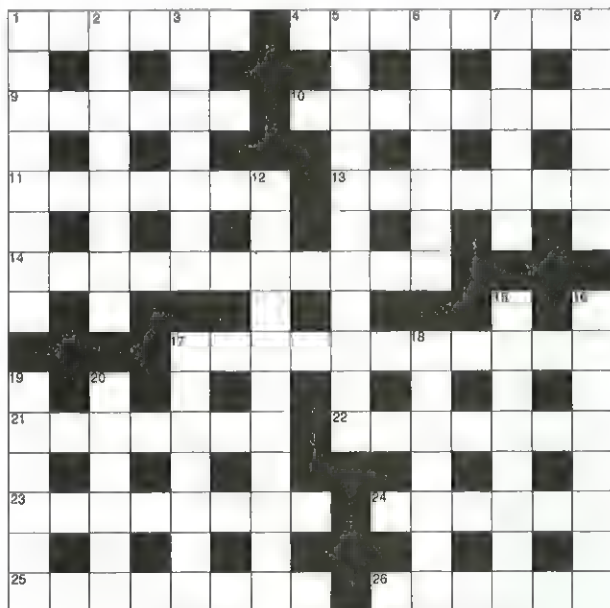


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.EXEWORD NOVEMBER



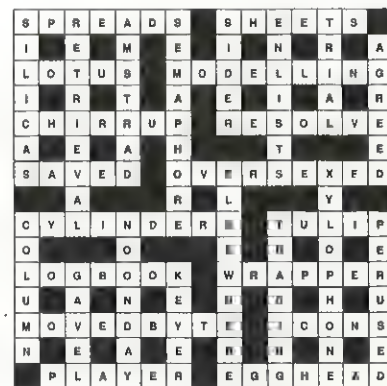
ACROSS

- 1 At a distance with a data item space (6)
- 4 Trivalent impurity may take something or... (8)
- 9 ...use structured works, musically (6)
- 10 Grinding gin hangs crookedly (8)
- 11 Chats round the Spanish holdall (7)
- 13 Carry out a repetitive approach (7)

- 14 The stuff of our technology (11)
- 17 More than a cosmetic improvement, one hopes (11)
- 21 Rupert follows program error - what a nuisance (7)
- 22 Work of a linker in organisation (7)
- 23 Find the significance of an expression (8)
- 24 Chips' raw material (6)
- 25 Young Edward goes round there like a goat (8)
- 26 Shook hands on silver grass (6)

DOWN

- 1 Coupler for the hotel room? (8)
- 2 Work out what's what, on parade? (8)
- 3 Tanned matter (7)
- 5 Branching statement (11)
- 6 Oriental source of much hardware... (7)
- 7 ...here, for instance, where I want a change (6)
- 8 Dubious values at the rear (6)
- 12 Plastic copy of 3 may heat one way or another (11)
- 15 Shed fluid with hard work (8)
- 16 Norm to look up to (8)
- 17 Carry out - capital? (7)
- 18 Oriental grains cooked when wiping the files (7)
- 19 Complain about final code (6)
- 20 Horrified when Silver has the start (6)



.EXEWORD OCTOBER

NCC CANCELS COURSES AFTER IRAQI INVASION



Rick Firth, Director of Training, NCC

The National Computing Centre has had to cancel software engineering courses for six Iraqi students because of the invasion of Kuwait.

The students, from the Iraqi National Computing Centre in Baghdad, were going to be trained by the NCC in the UK and the United Nations was going to foot the bill.

In addition, the NCC was going to send training materials on software engineering, project management, verification, validation and testing and software engineering principles.

After the Iraqi invasion of Kuwait and the adoption of UN resolution 661, however, the NCC received notification from

the UN that the courses were to be suspended.

A spokesman for the NCC said that some time after the courses had been cancelled, the Iraqis had sent a telex from the computer centre in Baghdad enquiring as to the whereabouts of the training materials and asking for suitable dates for the students to come to the UK. He said the telex seemed to back up 'the commonly held belief that computer departments are in a world of their own.'

The courses were to be the first contact between Iraq and the NCC after business ties between the two were severed when Iraq invaded Iran eight years ago.

Commenting on the Iraqi episode, the NCC's head of training, Rick Firth, said: 'We were just beginning to get back to normal, after the break during the Iran/Iraq war, when Iraq went and invaded Kuwait. Despite demonstrating a periodic interest in educating its people in the use of computers, Iraq is much more interested in fighting wars.'

COMPUTER SERVICES WORKFORCE GROWTH DOWNTURN

The computing services industry suffered a sharp drop in growth of staff numbers for the second quarter of 1990 and the prospects are even gloomier for the rest of the year, according to the Computing Services Association.

Figures released by the CSA, the trade organisation for computer software and services companies, show that growth was less than 1% for the second quarter. The growth rate has been falling steadily over the past year from a peak of 14% for the year 1988-89 and, according to the CSA's director general, Dr Douglas Eyeions, the trend is 'accelerating downwards.'

The CSA is in the process of collecting figures from member companies for the third quarter which are expected to be even worse. Staff numbers have declined over the past 18 months as a number of computer services companies have laid off staff and suffered from falling revenues.

Eyeions highlighted several reasons for the fall including a serious decline in the defence and city sectors. In addition, a number of large companies were deferring expenditure on new projects, preferring to carry on with existing systems.

'There has been a decline in the number of large capital projects. People are not taking on new projects. In the current climate, where a lot of small companies are going to the wall, the larger ones are delaying the installation of large computer systems.'

Several CSA member software companies are losing more people than they are recruiting. CSA member companies employ 64,000 people, nearly four-fifths of the total number of software and services specialists in the UK. If staff numbers fall in the second half of the year, it will be the first drop since the early 1970s.



Eyeions: staff numbers accelerating downwards

ETHICS AT WORK LAUNCHED

A new organisation aimed at bringing the discussion of ethics to the workplace has been launched by Exchange Resources ethical consultant, Dr Pat Haggard.

Ethics at Work is a spin off from Dr Haggard's work for ethical recruitment agency, Exchange Resources. A newsletter released by Ethics at Work at the end of October contained articles on subjects such as how to broach the subject of ethics with management.

Dr Haggard said the organisation, which has applied for charitable status, would be going to exhibitions which businessmen and middle management were likely to visit. It also hoped to put together educational programmes for school and other educational institutions.

'In this decade, ethics will be the topic for discussion in business, the professions and the working world. Ethics at Work aims to provide a forum for that discussion,' she said.

Membership subscription for the organisation is £25 and interested parties should contact Dr Haggard at 28 Milsom St, Bath, BA1 1DP (Tel: 0225 469671).

Billy MacInnes

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Our client a small independent well-established SOFTWARE DESIGN CONSULTANCY specialising in Real-Time Technical Applications, is looking for two additional SOFTWARE/HARDWARE ENGINEERS (Junior - Intermediate level) to join the Development Team.

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Prestigious corporation requires high level consultants with an all round knowledge of the PC market and specialist expertise in either XWindows, Databases, or networking/communications to administer consultancy to senior I.T. professionals.

PC ANALYST PROGRAMMER CLIPPER

£17500 + BENS + MORTGAGE SUB

Financial institution have vacancy for ambitious individual with minimum 12 months' experience as PC analyst/programmer. Experience of Clipper. Knowledge of Networks useful.

NETWORKING SUPPORT

£18k + Car

Major distributor requires systems engineers with experience of Novell P.C. LAN or Torus.

TECHNICAL SOFTWARE SUPPORT

£10k + Car

Micro Computer manufacturer requires P.C. support specialists with 6 months' + experience. Probably from an End-User dealership background you will have a knowledge of a variety of 'off the shelf' packages e.g. dBase, Lotus, Multimate, Pegasus, Smart, etc. to provide support to dealers, distributors and VAR's.

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hours or 0582 456417 eves/wkends.
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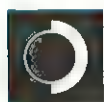
OXON/BERKS £16k - £28k International developer of modelling software seeking some of the following skills: Fortran, 'C', GKS, 3D, UNIX or X-Windows.	OXFORD to £25k Designer of LAN products (FDDI 100Mb) utilising 32-bit RISC processors you should have 'C' under UNIX or MS-DOS or Comms experience.
BERKS to £25k 'C' and Intel Assembler required for development of PC o/s interfacing Graphics and Networking.	LONDON to £25k Document Image Processing & Networking development if you have good OS/2 with one of 'C', Assembler or Windows.
MIDD to £20K [1] Developing Project Management software you should have two of: 'C', Oracle, UNIX, SQL Forms, SQL*, DOS, VAX/VMS or RPT.	SURREY c£22k [1] Scientific Database analyst/programmer required with 'C', 4GL and UNIX with one of: Sybase, Unify, Oracle or Ingres.
[2] Leading developer of control and datacomms systems is seeking a software engineer with 8086 Assembler. Yourdon training provided.	[2] New communications management software if you have at least two of: 'C', OS/2, UNIX or CDOS. c£22k
[3] Experienced 'C' developers sought to join small highly motivated team developing state-of-the-art business systems including Graphics, Lan's, UNIX, Comms and Financial Planning. £ excellent	HANTS £16k - £20k Develop high performance data acquisition with interactive graphics if you possess at least two of: 'C', Pascal, Assembler or Device Driver experience.
[4] Parallel Computing specialist seeking 'C' experts with at least one of: UNIX kernel, TCP/IP, Op. Systems, Device drivers or NFS. £ neg	HERTS £ excellent Integrated Office Automation specialists seek UNIX/'C' experience in an applications environment. Regular training and career development programme.
AVON & OXFORD to £22k Design & Development of high integrity Real-Time systems if you have at least two of: Pascal, 'C', ADA, I80x86, M680x0, Z8000, JSD, Yourdon, CORE, Mascot or SSADM.	EUROPE to £25k International organisation involved in communications development seeking Comms or real-time experience with at least one of: UNIX 'C', SUN, Yourdon, X.25, CCITT, OSI, X.400.

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Software Consultants - to £25,000 p.a. plus car

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We are also looking for candidates to work in these areas at Engineer and Consultant level. For the Software Test and Quality Assurance positions less programming experience is required, but familiarity with computers and experience of applications on PC's is desirable.

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#INCLUDE experience.h/* 2 yrs+ required*/

#DEFINE ENVIRONMENT "Development"

#DEFINE PACKAGE "Excellent"

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{

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printf ("we meet all relevant candidates/n evenings also/n")

}

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ESSEX

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Analyst Programmers will require two years' DP experience one of which must have been within a UNIX environment ideally with some exposure to 4GL's.

BERKSHIRE

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The emphasis is very much on software skills and therefore a good degree in a computing discipline is required together ideally with a minimum 3 years relevant experience.

Ref No: 046/exe

C/UNIX/X-WINDOWS

Software Engineer Up to £16,500 p.a.

Our client is a leader in the arena of real time manufacturing control systems where the emphasis is placed on the graphical presentation of information and HCI issues.

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Ref No: 016/exe

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Ref No: 003/exe

'C'/UNIX & INTERACTIVE GRAPHICS

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Positions entail programming on SUN/UNIX workstations using 'C'. Ideal applicants should be graduates in a mathematical, scientific or engineering discipline, and have experience of 'C' and database programming.

Ref No: 360/exe

If you are interested in learning more about the above and other opportunities we would like to hear from you. We maintain a strict policy of not presenting CV's to our Clients without firstly gaining an understanding of the personal requirements, career aims and technical skills of candidates applying through our company. Therefore you can be assured that you will receive a qualified service of the highest professional standards. For further information and a confidential discussion please contact us on (0256) 882826 during office hours, or (0256) 850534 evenings/weekends. Alternatively write to us at the address below and we will contact you at a time convenient to you.

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FORTH AND DEC	Hemel Hempstead	All levels required up to £25K	Ref D167
Complete team required for development of Radar system, experience with modern methodologies essential, ADA an advantage, but no essential.			
ADA, FORTRAN AND DEC	Portsmouth	£NEG	Ref D134
Manufacturer of reflective radar material needs person with above.			
PASCAL, RDB AND DEC	Brentford	All levels required up to £20K	Ref D167
Large multinational pharmaceutical company requires a number of persons with these skills.			
ASSEMBLERS AND PLM56	Watford	£All levels required	Ref D119
Manufacturer of Medical Equipment requires individuals to assist with development, knowledge of embedded systems needed, hardware and Modula-2 an advantage.			
PLC AND REALTIME	Crawley	£16K	Ref D109
Large PLC manufacturer requires a Software development engineer.			
PLM, ASM AND PC	Enfield	£NEG	Ref D122
A Multinational Company which Designs and Manufactures military simulators require software engineers for Product support work, interfacing, some hardware experience an advantage.			
C, WINDOWS AND UNIX	Finsbury	£NEG	Ref D144
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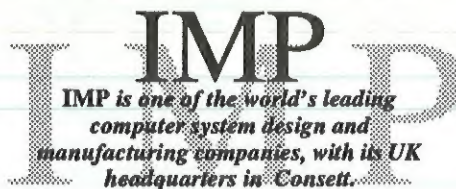
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Applicants will have a degree in Computer Science or a related subject, and two or more years' experience of programming in "C" within a Unix environment. Additionally, in the case of the communications engineer, experience of TCP/IP, STREAMS and synchronous communications protocols would be an advantage.

Applications or enquiries to: Mr. Ian Cowan, IMP Ltd.

I M P



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*'Isambard Kingdom Brunel, 1806-1859. If he was alive today, he'd probably work for us' -
advert for Keen Networks in Infomatics magazine.*

I sat in Keen Networks' entrance lobby, leafing through a magazine, and wondering what was in the large glass aquarium, which hummed and bubbled quietly by the door. A receptionist, who, as usual, looked a shade too much like Angela Rippon for her own good, was pretending to hack around in Wordstar. As she typed, she kept glancing at me, just in case I got the urge to make off with some of the glossy mags that were lying on the coffee table. .EXE, of course, *Modern Computers, Business Networks, Arthritis Today...*

I was on the point of getting up for a closer look at the tank when a middle-aged man in a grey pin-stripe appeared at the door. 'Miss Stob? Hi. I'm Mike Keene. I understand you've come to meet the genius IKB?' We shook hands, and he led me out of reception down the corridor.

'What is he working on?' I asked, as we arrived at an important-looking door.

'Oh, this and that. You know. With a man of his capability, you just give him an office and some equipment, and let him get on with it. Isambard' - this shouted through the door - 'Isambard, you have a visitor.'

As he opened the door, I caught a whiff of the hospital smell: disinfectant, sweat, vomit. The small office seemed empty, except for a large Keen Network computer in one corner and a kidney dialysis machine in the other. Then there was a whine of an electric motor, and a wheelchair appeared from behind the computer. In it was seated a wizened husk of a man, wrapped in a dressing-gown. The wrinkled skin of his bald pate and face was a light grey, and a feeble claw operated the controls of the wheelchair. The sealed ends of his pyjama bottoms, neatly pinned flat, spoke forlornly of amputation. He was dribbling slightly from the left side of his mouth slit. He looked like Davros-creator-of-the-Daleks on an off day.

Brunel's remaining watery, venous eye peered at me. Suddenly his hand twitched, and the wheelchair lurched towards me. 'Seven foot and a quarter inch! Seven foot and a quarter inch! SEVEN FOOT AND A QUARTER INCH!' he cried in a thin, mad voice, as he accelerated. Keen grabbed me by the elbow and pulled me out the door, slamming it to behind us. There was a sickening crunch, and a horrid wail.

'I'm sorry, Miss Stob. IKB is not himself. He's terribly cut up about the adoption of 4ft 8in as standard gauge. He's only just discovered that they used it in his Rotherhide-Wapping tunnel', explained Keen.

'Surely', I said, determined to make some use of the research I had put in, 'Surely the tunnel was built by Isambard's father Marc, who...'

'Who is in room 182. Would you like to meet him, Miss Stob?'

I wanted to meet some fresh air. 'That's all right, Mr Keen, I really must be getting on.' I backed off towards the exit, with Keen calling after me: 'But you haven't met Sir Isaac - I've had his iron lung polished specially for your visit.'

I broke into a trot at the door to the reception, but as I passed the aquarium, I tripped on its wire and pulled the whole thing crashing to the ground... In the puddle, amongst the broken glass and electric wires, something coloured porridge grey flopped nastily.

The receptionist peered over her horn rims, then called back to Keen: 'Now she's done it! Archimedes is out of his bath.'

Opportunities for Software Professionals

IBM / DEC SYSTEMS

★ PROGRAMMERS TO PROJECT LEADERS

MIDDLESEX **To £30K**
Excellent opportunities exist with this major international company for ambitious individuals with experience in one or more of the following: **PL1, IMS-DB/DC, FOCUS, IBM ASSEMBLER, WINDOWS, C, APL, DB2, ORACLE or COBOL.** A background in **MVS** or **XENIX/UNIX** would be an added advantage to help them develop and build tomorrow's systems today.

Ref: ACH 0202/03

★ SYSTEMS ANALYSTS

MIDLANDS
Vacancies exist in the areas of merchandising, distribution retail and finance for candidates with IBM Mainframe, COBOL, CICS, DL/1 and DB2 backgrounds. You will be involved in the feasibility study, analysis and design of new application areas and enhancements to existing applications.

Ref: AH/1005/53

★ ANALYST PROGRAMMERS

BERKSHIRE **£25K**
Our client has an urgent requirement for ambitious, self motivated candidates with **IBM AS400 COBOL/RPG** and **mainframe (MVS) COBOL** skills. They may also consider candidates who have gained COBOL experience in a variety of different environments such as **DEC, HP, WANG or HONEYWELL.** It is essential to have two years' experience and be willing to travel in the UK and Europe to secure a position with this dynamic company.

Ref: AH/2808/05

★ SYSTEMS DEVELOPMENT

GLOUCESTERSHIRE **£15K**
These positions require candidates with one or two years' programming experience using **COBOL**, preferably on **DEC VAX** equipment, but consideration will be given to others with good **COBOL** skills. Experience of **POWERHOUSE 4GL** would also be an added advantage, but is not essential as training will be given.

Ref: ACH/1209/23

★ ANALYST PROGRAMMER

CITY **£15-25K**
Ambitious individuals with one or more years' experience of **COBOL, BASIC, C, DEC VAX, UNISYS or TANDEM** are required for the development of standard and bespoke financial systems. Familiarity with **ORACLE, INGRES, DB2 or LSDM** would be an advantage, as would previous city experience.

Ref: ACH/1009/10

UNIX * UNIX * UNIX

★ CONSULTANT

LONDON **c £25,000**
This international company seeks exceptional Computer Science or European Language graduates/MSc postgraduates to work in the area of product development. It is essential to have a minimum of two years' development experience using C in a UNIX environment and practical experience of SCCS, Make, sdb etc. You will be required to develop test suites, make modifications and enhancements to code and produce the necessary documentation. Other aspects of the job include in-house technical support and pre and post sales support.

Ref: AH/0808/11

★ SOFTWARE ENGINEER

HAMPSHIRE **To £18K**
Join an experienced team designing and developing software that will run on 386/486 PC's. Development work will be on PCs under **Microsoft Windows** and in a networked **VAX/VMS** environment. Candidates must have two years' C programming skills and experience of the above mentioned systems.

Ref: ACH/2908/00

★ SYSTEMS PROGRAMMER

BERKSHIRE **TO £17K**
Create new Run Time Systems using 8086/80286/80386 assembler and provide maintenance support to all OEM customers. Additional experience of three of the following is essential: - DOS, OS/2, COBOL, C, FLEX, UNIX or VM.

Ref: 1630/05

SUPPORT

★ ICL TECHNICAL SUPPORT

NEWCASTLE **£20 To £30K**
Our client is seeking several candidates with solid experience of TPMS and IDMS for a variety of positions ranging from Base support to Technical support managers. Other experience such as X25, SCL, INGRES and UNIX are also of interest.

Ref: ACH/2408/60

★ SUPPORT CONSULTANT

NORTHANTS **C £20K**
Use your UNIX, XENIX, INFORMIX, SQL, C, or TCP/IP skills in a busy role involving second line support to customers for UNIX packages and their interaction with other software products. Any experience of Uniplex, Professional or Acuity would be an added bonus.

Ref: ACH/1209/55

REAL TIME

★ SOFTWARE ENGINEERS

MIDDLESEX **£22,000**
Software specialists with skills in C, PASCAL, ADA, ASSEMBLERS, UNIX, VAX/VMS and structured methodologies are required by this expanding Systems House.

Ref: ACH/1308/03

★ SOFTWARE DESIGNERS

AVON, SURREY & MANCHESTER **£25,000**
Opportunities exist for engineers with experience in ADA, CORAL 66, PASCAL, MC68000, Object Oriented Design, Database design and 4GL's. You should be degree qualified with a minimum of three years' experience in the development of real time systems.

Ref: AH/3107/00

★ KNOWLEDGE ENGINEERS

HOME COUNTIES **£15-25K**
Rapidly expanding Expert Systems Software house requires young developers to design and implement projects. 1 year's experience minimum of any AI language or C, and UNIX etc.

Ref: 01699

★ SENIOR SOFTWARE ENGINEER

HAMPSHIRE **c £20K**
Utilise your realtime programming skills in C, ADA and ASSEMBLER, and join a team engaged in the design and development of software modules for use in control equipment. Practical experience of structured software design and test methods, along with knowledge of MS-DOS or UNIX is desirable.

Ref: ACH/0309/00

GRAPHICS / CAD

★ SOFTWARE ENGINEER

HERTFORDSHIRE **£20,000**
At least five years software engineering experience, including programming with DEC VAX/VMS operating system or UNIX is required, to work with this small team in the design and support of colour graphics systems. Familiarity with ETHERNET, Intel Microprocessors and X-WINDOWS is desirable along with any experience in a graphics related industry such as CAD or SCADA.

Ref: AH/2507/21

For further information on these or related positions call JEREMY WILLAN or SARAH HOLTHAM on (0734) 774234 or (0604) 33195 after 7p.m. FAX: (0734) 772773

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